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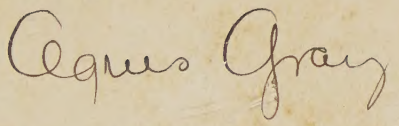

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THE OPERATING ROOM

A PRIMER FOR PUPIL NURSES

BY

AMY ARMOUR SMITH, R. N.

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To

MISS LUCY ANN MARSHALL, R. N.,

THE BEST ADMINISTRATOR I HAVE YET MET

INTRODUCTION

To take the experience and teaching of an active professional life and incorporate it within the compass of this volume is no small task. To formulate and present the background of theory and science of operating-room practice is difficult and does not lend itself to conciseness. The author has written a book for the operating room and of the operating room and has set forth clearly and distinctly the general principles and the specific detailed information that go to educating the nurse to the fullest degree in all that pertains to the organization, administration, and conduct of an operating room. In the ever-widening field of surgical knowledge and the closely related specialties of medicine it is opportune that there should be collected and printed the last word, so to speak, in operating-room technic. In the bewildering array of facts to be mastered, technical procedures to be learned and the tremendous importance of the preparation of everything connected with an operation so that there will be no possibility of contamination or soiling we have a task that will test the physical and mental capacity of the most ambitious young woman desiring to make herself proficient in operating-room technic.

Few surgeons, hospital superintendents, and superintendents of nurses seem to realize the tremendous organization that is represented in the operating-room departments of the modern hospital. Mrs. Smith begins her treatise at the operating room itself, and by carefully calculated and well presented chapters conducts the neophyte through the physical make-up of the operating room, the duties that pertain to the various positions of circulating nurse, anesthesia nurse, suture nurse, and

operating-room supervisor. Large as are these designated duties there is still a larger domain in operating-room pedagogy. The necessity for a thorough knowledge of the mechanics of sterilization, the preparation of solutions, and dressings, the maintenance of supplies and the disposal of soiled material, furthermore, the enigma of surgical nomenclature, the relationship between the superintendent of the hospital proper and the supervising nurse of the operating room are all important and make for success or failure in administration. These are all fundamental topics which must be thoroughly mastered before one is able to comprehend fully the mental equipment necessary for the proper and efficient maintenance of an operating-room pavilion.

The volume is essentially practical and with its detailed instruction is immediately available for the probationer as well as the graduate nurse. The author has, however, given discursive information about the principles underlying the practical application of the precepts which enable the reader to understand that larger background which must necessarily precede the application of all knowledge.

The members of the medical profession who have been identified with hospital committees on the administration of operating rooms will appreciate readily the difficulties of transmitting operating-room knowledge to each succeeding nurse as she progresses in her hospital rotation through various subordinate positions in the operating-room department. To administrators in general this book should be particularly useful and prove to be a practical guide to the nurse beginning her training and who for the first time enters the operating room with its tremendous detailed work and finds herself at a loss to understand the complicated machinery to which she is introduced. To the nurse who occupies one of the subordinate positions in the operating room it will be found invaluable to consolidate her information and give it an orderly place in her mind. To the graduate nurse oc-

cupying a senior position, such as suture nurse, or supervisor of one of the minor operating rooms, it will be a regular vade mecum, with its precise information, its admirable illustrations, its charts, and its complete formulary and glossary of technical terms. To the nurse occupying the position of supervisor of operating rooms it will form the basis of regular systematized lectures and provide a comprehensive viewpoint of the whole domain of skilled nursing and operating-room administration such as is necessary in the conduction of any well-established surgical clinic. To the superintendent of nurses and the hospital superintendent it should provide a standard whereby the derelictions of their own service may be evaluated in terms of modern operating-room efficiency. It will well repay the surgeon to peruse it that he may better appreciate that as the active and professional unit in the group he must of necessity co-ordinate his activities with all of the associates that contribute to the running, the maintenance, and administration of the surgical department.

The desirability of having such information in a concise, well-planned and co-ordinated volume is apparent and it is with the greatest personal appreciation of its prospective usefulness to the nurse, to the supervisor, and to the surgeon that it is presented to the medical public and nursing profession at large.

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Professor of Surgery,
New York Post-Graduate Medical School and Hospital.

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New York City.

FOREWORD TO SECOND EDITION

The mere acknowledgment of the help received from the many surgeons mentioned in the text of this edition, whose genius evolved the special features mentioned as aids for nurses in operating-room work is far from enough to convey the real thanks of the author to them, nor can words express the feelings stirred by the warm hospitality of her own school, in the New York Post-Graduate Hospital, extended during its compilation, and crowned by the generous remarks of one of its brilliant surgeons, Dr. Charles Gordon Heyd, by way of introduction. The firms whose applied science lent help in the form of electrotypes of up-to-date apparatus, Meinecke & Co., Kny-Scheerer Corporation, and others, have contributed in a very kind, prompt manner to the possibilities for its usefulness.

Amy Armour Smith.

New Rochelle, N. Y.
September, 1924.

FOREWORD

This little book has been slowly and anxiously pieced together not by one continuous task, but by culling an idea here, a formula there, a test somewhere else, from the conversations of numerous good friends in the medical and nursing professions, and from happy memories of days in training under the kindly, thorough instruction of Miss A. M. Rykert and Miss J. MacCallum (now Mrs. Schenck, of Detroit), for the opportunity to be under whom those who were so fortunate have been increasingly proud and grateful as time goes by. Yet, withal, this book will seem rather crude in comparison with the finished work of experienced authors. Generously excuse its faults on the ground that it is only a pioneer, *from a nurse to nurses*, and not from a physician to nurses! These data have been garnered from journals on nursing, from physicians' libraries, and from the practical experiences of friends. If its humble appearance proves to be an inspiration to others more skilled, to take up the labor and go farther, it will have accomplished much. If, again, any nurse chances to learn that she too can constantly acquire information that may be at any time, no matter how remote, tremendously useful to her, it will not have been written in vain.

My sincere thanks are due to Dr. T. Mitchell Prudden and Dr. W. M. Brickner for permission to quote from their valuable works, to Dr. C. A. Smith and Dr. C. H. Fulton for their constant personal assistance, to Dr. E. M. Smith and Dr. A. Beck for contributions on their special lines of work, to Mr. F. H. Kollman for useful pharmaceutic data, and to the firms Kny-Scheerer Corporation,

Foregger Co., Inc., Lentz & Sons, for the loan of numerous electrotypes, and to J. F. Newman, manufacturing jeweller, for the design on the title-page.

Most especially, however, this work has been forwarded and is largely due to the encouragement and careful revision given by Miss B. I. Brazeau, R. N., and Miss I. M. Hall, R. N., two operating-room nurses, whose absolute conscientiousness, skill, and willing spirit, enhanced by many tenderer graces that make the perfect woman, deserve a far higher tribute than can here be given.

"The Trained Nurse and Hospital Review" kindly gave permission to use the original articles which were expanded for some of these chapters.

AMY ARMOUR SMITH.

NEW ROCHELLE, N. Y.

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THE OPERATING ROOM

CHAPTER I

THE NEW OPERATING-ROOM PUPIL

"A task!—To be honest, to be kind; . . . to renounce when that shall be necessary and not be embittered; to keep a few friends, and these without capitulation; above all, on the same grim condition, to keep friends with himself; here is a task for all that man has of fortitude and delicacy."—*Robert Louis Stevenson.*

Rotation of Service.—The directress of nurses should keep the operating-room supervisor thoroughly posted about the pupils' rotation of service, so that a new pupil's arrival in that department does not interfere with the smoothness of its workings. Taking into consideration

Illness,
Vacations,
Other emergencies,

there should always be one reserve nurse at least in the small hospital, more in the large, who is free for call to that service when needed. There is a tension and importance about this "core of the house" that demand a sort of militarism in the establishment of a special body of nurses "who have had operating room." To the public the operating room holds the seeds of the future success of the institution, for surgical results are more tangible than medical. Hence, though the personnel shifts, each day's job must be perfect. This demands forethought and team-work among the staff nurses.

The First Day.—The supervisor daily must draw up a complete program of how each hour shall be spent by

each nurse. With a competent senior, she can feel free to begin at 7 o'clock teaching the novice her primary duties:

1. The floor plan of the suite, hitherto unvisited.
2. The personnel, called when needed.
3. The utensils and supplies to be handled in her first shifts.

The supervisor who would be successful speaks in a low, clear, emphatic voice, reaching only the one pupil, and not too fast, following home each thought by a study of the listener's eyes to see if she is paying attention, and quizzing her for proof of same. The trend of modern public school education has not been productive of honesty and concentration, therefore the pupil must make a tremendous effort to grasp and keep each direction. A capable supervisor has a sixth sense that tells her whether her instruction is getting through or not. If she feels that she is talking to stone, she must persevere till she can prove that the pupil can absorb, or is hopeless.

Psychology of Training.—A new pupil is sent in haste by all the corps to find instruments and apparatus. She cannot find anything in a moment of panic if she has no mental image of it. When a thimble is lost right before one's eyes it is because the mind is on pears or boats. One must visualize the thimble. The supervisor is ahead of the game by laying out everything that will have any possible bearing on the case, naming each object and describing its use, with the aid of the anatomic chart. One case is enough to prepare on the first day, so that the pupil may stand in the operating room and see the process completed. She is guided constantly to form the habit of keen observation.

The Surgeon's Relation to the Novice.—The successful surgeon has an academic relation to the new pupil. Apparently unpromising material often makes a substantial, reliable operating-room nurse. The surgeon is a teacher, and his obligation to the pupil arises from the position he holds on the staff, awarded him by public

confidence. Through the shifting of the pupils his work flows out into the community, beyond even the bounds of the state, by the constant preparation of nurses to carry on this department in new or enlarged hospitals. This can never be done by ignoring or snubbing a nurse. The surgeon is very dependent on assistance from nurses. If a pupil appears at a disadvantage, the cause must be studied by the supervisor and prevented from happening again. Personal interest must be eliminated in the operating room. This is the hardest thing to school one's self for in the whole three years' training, especially because someone higher up may occasionally be lax. The surgeon who is big enough to take no notice of looks, age, or anything else not directly bearing on the perfect performance of a task, who can perceive the mental attitude of his assistants, and broaden, deepen, or concentrate it by

Anticipation of his own needs,
Instruction in running comments,
Encouragement

will exert control over the welfare of thousands of people.

The Pupil's Responsibility to the Surgeon.—The pupil must realize at once that her speed, forethought, and presence of mind affect the results of an operation just as much as the share taken by any other person. The patient on the table may pass out if she fumbles in getting a stimulant, and *that will be her fault.* He may be unnecessarily weakened by hemorrhage if she forgets where the extra hemostats lie. The avenues from the operating room to the public life of the community are:

1. The patient and his family.
2. The surgeon.
3. The outside physician who referred the case to him and judges his skill by the result.
4. The patient's neighbors.
5. The hospital board.
6. The undertaker.

The supervisor should arrange to have strong support for the surgeon from the reserve corps when there is a

shift in the personnel, but to have the new pupil perfectly equipped by chart, instruction, and rehearsal for one case.

The Operating Room as Related to the Community.—Probably no other nurses see so little community life, on account of

1. Long hours.
2. Emergency calls.
3. Concentration on one point of service.
4. Absence of relatives in the field.

Hence the supervisor must constantly remind the pupil of the broadest aspects of her work. The training of operating-room nurses is only *incidental* to the general scheme of the community to

Cure the sick,
Reduce disease,
Reduce expense,
Produce happiness.

Progress in Methods.—Formerly a new pupil was regarded as a maker of supplies, and was set down in front of a pile of gauze and told to manufacture it into useful forms, supposedly absorbing operating-room methods casually in a left-handed way. Then, badly prepared, without charts or demonstrations, she was passed on as a prop to a critical surgeon. This was the cause of much bitterness. Now supplies are made in a supply room far from the tense atmosphere of the operating room, but under the instruction of the supervisor. They may be made by

1. Pupils.
2. Junior Auxiliary of the hospital.
3. Red Cross.
4. Friendly special nurses.
5. Clean orderlies.

The pupils are familiar with all forms of dressings when they spend a period in the supply room, which is a good sedative for the tired or nervous.

The Telephone.—On account of the longish period occupied by operations, and the general practice carried on

by many surgeons outside, there are frequently pressing messages over the telephone not to be found usually in ward rounds. The pupil answering the telephone forms again a very important link with the community, and should take the message with all its details, and deliver it thus to the surgeon:

Dr. ———, may I give you a message that is urgent?
Person calling,
Address,
Message,
Time, etc.,

in a clear, distinct tone, close to his side. Then the surgeon gives his reply, which she delivers similarly, bringing back further conditions if necessary. Were it not for this service, a good surgeon might miss being called in consultation or other forms of cases. The supervisor should keep a printed list of the operators and those who view or refer cases, especially emphasizing foreign names. A local directory with maps is an essential feature also, so that odd names of streets, and such details as

Lane,
Place,
Terrace,
Park,
Avenue,
Street,
Highway, etc.,

can be comprehended by any nurse, who may have come from Texas or Newfoundland herself. This helps develop business acumen too. An operating-room telephone should be a desk set, with comfortable chair, pad and pencils always sharpened for messages, not a wall set with no place to write.

Morals of Pupil.—The foundation of all operating-room work is honesty. The supreme mental anxiety of the heads of institutions entrusted with the care of lives and

accurate research, who feel that they are leaning on *some* nurses whose daily conversation is a tissue of white lies and froth, cannot much longer be uncomplainingly borne. Many good nurses are remaining out of institutional life for the reason that they do not feel they can depend absolutely on *all* the pupils. Hence the operating-room supervisor may take each nurse only on probation. If she sees tricky deceits, such as

Omitting dusting,
Opening the autoclave too soon,
Measuring medication carelessly,
Not counting sponges,

she should be able to get rid of her—back to the wards, where less damage can be done, till she makes good again. This is no use except with the team-work from keen ward supervisors. They should be allowed power to punish for petty dishonesty (which can grow). Frank talk, constant *overseeing*, combined with a nice judgment of human nature and quick approval for effort to improve, may help to correct these obnoxious conditions. Otherwise they become a festering sore in the hearts of honest nurses. There is a very common feeling that "anything is all right if one can get away with it," but the truly professional career of such as believe that is very short and disgraceful. If ever at any time in the history of the world, as a reaction after the inaccuracies and discrepancies in the disjointed period of the war, the honest, dependable nurse is widely sought and coming into her own.

CHAPTER II

THE CIRCULATING NURSE

"Life is a patchwork quilt, stitched on the background of Eternity, and padded out with the rags of Time. Strange colors we introduce! Here a dash of scarlet Passion, there a scrap of pure white Faith, then brown Doubt and pale-green Ennui! Most of us, however, have to fall back on the dull drab of Work to fill out the spaces, and thank God for it, for it rests the tired eyes."—Quoted from an old, old issue of Toronto "Varsity"; student author unknown.

The Numerous Duties.—This nurse's work seems hardest because it is new and apparently disconnected, a heterogeneous mass of "chores," a bewildering waiting on four people at once, all of whom equally insist on immediate notice, waiting for seniors to pass, finishing up what everybody begins, and jumping at every beck and call. Yet the circulating nurse is the foundation of success in the operating-room structure.

Dusting.—The modern principle of using unskilled labor where possible does not apply to dusting the operating room, or to many other duties some nurses would like to evade. Dusting in a hospital is a scientific process that must be performed by one on whom the institution can place responsibility for failure. A diploma cannot be withheld from orderlies and maids. Nurses are held accountable for all the accessories to the surgical procedure, including

Ventilation,
Lighting,
Heating,
Dustlessness.

Orderlies and maids cannot visualize bacteria, hence the work would be done unintelligently, and they are apt to leave on a minute's notice.

Nurses are members of a class in society, it is supposed, who take pride in work, who work because they

know labor is necessary to keep well and sane, who do their duty to their neighbor in the community, and who wish to satisfy a growing desire within themselves to attain more knowledge, more deftness, and general approval. An onlooker of shallow judgment should not give opinions of nurses' ability.

Compare Nurse A,

Who covers a great deal of ground, in long strides and strokes, occasionally letting things fall noisily, or breaking a big glass tank worth $50 or so, with

Nurse B,

Who is less in evidence, but whose work behind the scenes is honest and enduring,

Who boils the water sterilizers long enough per schedule,

Who scrubs every square inch of a given surface with Labarraque's solution and Sapolio,

Who places every pin in dressing covers with meticulous care.

It is peculiar and unfortunate that the opinion of doctors and supervisors seldom coincides about who is a good nurse. There is a sort of superficial smartness and precocity which take very well with surgeons during their tense strain. This type of nurse does not work hard and painstakingly behind the scenes, cleaning, scrubbing, working overtime, or covering required ground. Being physically rested and fresh, she appears to give help and support, which the surgeon gratefully receives. She places herself in an impressionable mood to receive a telepathic communication of the surgeon's next wish. She gets credit when little is due. The honest nurse may be tired from her conscientious work behind the scenes where the surgeon never looks, but she hands him sutures aseptically, the water with which he laves his fingers is sterile, and the instruments placed in the wound are sterile and edged.

The passing of instruments to a surgeon is the sole

feature by which he judges a nurse's ability. But it is really such an infinitesimal part of the total operating-room work of nurses, or of the surgeon's entire relation to his practice, that it must not overbalance the honesty of preparation and after cleaning up. Besides, were it only for the criticism of nurses who will always pass instruments, it alone is such a little part of the nurse's life and work as a future supervisor,

(*a*) In being able to teach it to others,
(*b*) In general morality and thrift,
(*c*) In being an example,
(*d*) In fitting into the hospital management,

that it must not be overemphasized. The head nurse need not betray the fact that the showy pupil is unthorough, but must make her do her part perfectly behind the scenes also.

In teaching the pupil to dust a standard method is employed, usually coinciding with that of the wards, only more complete:

1. Soap in a basin.
2. Water in a basin.
3. Wet and dry dusters.
4. Labarraque's solution, dilute for stains.
5. Bon Ami smeared on glass to dry.
6. Oxalic acid for rust spots—kept in poison closet.
7. Sapolio for spots.

The supervisor should dust the whole suite, then have the pupil show by doing each feature that she has absorbed it:

(*a*) Beginning in the corners of window and door moldings, thence to center.
(*b*) Working around a room in sequence, so as to indicate how much is done completely.
(*c*) Looking for dirt.
(*d*) Doing highest surfaces first.

The circulating nurse is not a Cinderella. If she dusts the whole suite the day is gone and she learns nothing

else. The anesthetic nurse should do her section daily, also the suture nurse.

Dusters of various kinds are needed in large quantities, of stout soft cheese-cloth, and dry lintless cloths to dry and polish. All articles for damp work are kept in the hopper room, which should be well ventilated and sunny. Mops, brooms, and brushes for each worker are kept separate on tagged hooks, so as to be easily checked up or found. Orderlies should do no cleaning higher than the floor except the chandeliers—and at all times supervised.

Learning.—In a hospital a pupil learns in two ways. Take anatomy, for instance. In class work she has the lecture, the chart, and the text-book. In the ward she has the doctor, the patient's wound, and the nurses' conversation. Similarly, in the operating room she is assigned certain duties while on a fixed service, *e. g.*, circulating, but she cannot help absorbing knowledge about the other two services, to which hers is subsidiary. It seeps into her system all the time, therefore she cannot go to the second or third position totally unfamiliar. This equips her for an emergency outside her own field. It is not becoming to stipulate how many pupils a hospital will have on the operating-room service, nor how long they shall stay, but there is obtainable in the annual hospital conferences a fair idea of the proper quota.

A Place for Everything and Everything in Its Place.—The circulating nurse strains every nerve to become a good suture nurse. There is a special glory in being able to hand a surgeon what he needs before he knows he wants it, but it is the flower of a long, painful growth. Daily dusting, putting supplies away, preparing for inspection, and taking inventory lead up to this. Best of all is the morning class in anatomy held by the head nurse. If there is a big program the school instructress or an intern or a ward supervisor should do it. Third, the working of every screw, lever, and button on instruments, cautery, and lights must be thoroughly known beforehand, learned

in a quiet lesson hour, and practised for speed before the audience comes. To advance the welfare of pupils and patients gives a lofty tone to the supervisor's work.

Control of Special Conditions.—In making rounds, the supervisor should point out existing difficulties and how to obviate them:

(1) To watch for the backward swing of a certain door, with a trayful of instruments,
(2) To keep screens in all windows,
(3) To swat a daring fly,
(4) To reduce noise,
(5) To keep steam out of the main room,

and show what the ideal conditions are, to foster in the pupil's mind the ideas which may result in finer construction or equipment in future hospitals. This quickens the dry bones of the daily round.

Utensils.—The care of utensils comes next. Enamelware, glass, metal, baskets, brushes come under this heading, each with its formulæ. (See chapter on Formulæ.) Here the relation of this duty to the surgeon must be shown. He runs a big risk when beginning to scrub up if he handles a brush not thoroughly cleaned after a pus case. The whole suite is a cobweb of points of contact between surgeon, patient, and nurse.

Linen.—The circulating nurse sorts linen to go down the chute to the laundry, all clots being washed out first in cold water and wet linen tied in separate bundles. Iodoform linen goes also in separate bundles. By a carefully trained laundry head co-operating with the superintendent of nurses a strict check can be kept, by the hour when sent, as to who let go down the chute

(1) An instrument of delicate make and value,
(2) A small pillow,
(3) A rubber sheet.

It is the lesson of a lifetime to make haste slowly with linen, instruments, and other equipment which is of untold value when it is needed. It is embarrassing to face the august business superintendent for destruction

of hospital property, returned from the laundry via his desk. One reprimand should be enough. If the offence is repeated the pupil's privileges should be temporarily withdrawn. The laundry man clears away the operating-room chute more often than the others for the sake of quick turnover of goods.

Counting Linen.—A modern building is so planned that nobody can steal linen. It is a circulatory system without any vents. The employees file out of one door past the offices, carrying no bundles without exciting the suspicion of the watchman. Operating-room linen is marked plainly, and of a different

Texture,
Color,
Pattern,
Laundering

from that of the wards. Ward supervisors finding it among their stock should report to the head of the laundry, and return it to where it belongs. The circulating nurse should see her linen taken from the chute, washed, mangled, and sent up, so that she can determine how to locate missing or destroyed articles. When a patient is sent to the ward the accompanying nurse should bring back all operating-room linen to go down its own chute and come back more quickly. The ward pupil receiving the patient should inspect the bed thoroughly at once, to get rid of all pus basins, clamps, chest blankets, or towels. However, it is not necessary to count the articles on account of the sealed route in which they travel, merely to scan their condition, as to need of repair, on return.

Building the Stretchers.—The pupil here learns the borderline between operating-room and ward supplies. When it is "for the good of the service" that she reclaims her own towels or sheets from the ward nurse's reach, and not as personal property, there need be no tartness of temper displayed at these contacts. The nurse should visualize herself as the patient on the stretcher, needing

Heat: Blankets of special color—red reveals no blood-stains.

Lifting: Stout short sheets of unbleached muslin—two persons.

Person at the head—anesthetist.

Person at the foot—ward nurse.

Covers: Chest blanket to prevent pneumonia.

Cap over head in good shape, to mask identity en route.

Protection from vomitus: Towels and basin at chin.

Surgical dressing: Binder, warm and dry, laid in position, if not applied on table.

Dress.—The circulating nurse should be easily picked out, wearing an operating-room cap, but no mask, and a gown with special pockets for pencil and pad, suitable shoes for tiled floor, and rubber heels.

Applying Binders.—The Scultetus binder should be well ironed and dry. For a laparotomy the pressure is first exerted at the bottom, braiding toward the top; for an obstetrical case the pressure is first exerted at the top, braiding toward the bottom. This must be done very well and quickly,

(1) Before vomiting might begin,

(2) To keep the abdomen from chilling.

A long, solid *footstool* is necessary to give a short nurse purchase, to tighten the binder at this unusual height.

Scrubbing Up.—Far be it from a nurse to dictate the best method of scrubbing up, as opinions on this vary widely in the well-regulated operating rooms. The main principles are:

1. Genuine personal cleanliness in general, nails trimmed very close.
2. Removal of dirt by soap and brush, systematically following the pattern of the hands.
3. Loosening under the nails.
4. Scrubbing again.
5. Disinfecting in soak of prescribed solutions.
6. Drying with sterile towels.

7. Donning sterile gloves.
8. Tests by the pathologist at unexpected times.

"A chain is no stronger than its weakest link" is the universal motto of surgery. The circulating nurse is quietly watched by all the oldsters when she first scrubs in the amphitheater, and if she silently minds her business and works honestly for the stipulated period she gains the first lap in their confidence. She can make or mar the operation. Donning a mask before and a gown after the scrub complete the preparation when going to take part.

Holding Retractors.—She is frequently called to hold retractors, being physically more fresh than the seniors who are depleted by a long term in superheated air. Hence her knowledge of asepsis and her conscience are tested early.

Setting Up.—She may be taught to set up for any cases short of laparotomies and bone-plating. There are nice shades of difference as to

(1) The extent of the field,
(2) The rigidity of asepsis,
(3) The strength of disinfectants,
(4) The preparation of instruments

between a strabismus operation and a herniotomy. The circulating nurse may set up, and work to the point where the suture nurse may carry on when the surgeon arrives, in running off a big program in two or more rooms.

Regular Duty of Circulating Nurse During Operations:

1. Furniture is wiped off with 5 per cent. carbolic acid.
2. As listed for her, she lays out
   Gowns, caps, brushes,
   Table covers, towels,
   Sponges, bandages.
3. Carries in solution basins, fills them.
4. Opens jars without contaminating and recovers.
5. Carries in instrument tray, holding it well out from her body.
6. Picks up, washes, and boils all dropped instruments the proper length of time, carrying watch, to prove herself right.

7. Lifts special basins out of utensil sterilizer with forceps (Fig. 1), so that her head and arms do not hang over the tank.
8. Fills basins with sterile water from pitcher covered with a folded towel, through which loop she slips a finger to uncover it.

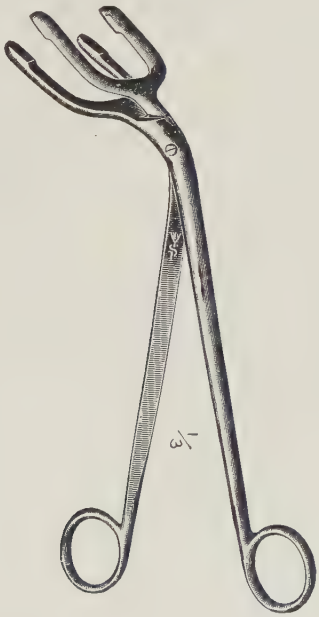


Fig. 1.—Sterilizer forceps for removing basins from the utensil sterilizer.

9. Tests certain solutions with glass thermometer floating in a harmless disinfectant and lifted by forceps.
10. *Never takes anything off sterile tables.*
11. Administers or prepares for
    Hypodermic,
    Lavage,

Enema of coffee,
Lumbar puncture,
Intravenous infusion,
Catheterization,
Douche,
Hypodermoclysis,
and records same on chart over her own signature.

12. Renews supplies for anesthetist.
13. Takes nursing charge of patient when necessary.
14. In bone-plating, resterilizes every instrument when used once, and keeps the small sterilizer boiling.
15. Runs the cautery.
16. Keeps the sponge count—picks up with forceps and counts soiled sponges.
17. Covers the patient with hot blankets from the warmer when in shock.
18. Drapes the patient in first drape, with unsterile sheets, with warm towels on the Kelly pad.
19. Puts the patient in
Trendelenburg,
Sims,
with feet well wrapped in thick blankets when in mid air.
20. Never is missing when needed.
21. Presents privileged visitors with armless gowns.
22. Keeps all plumbing fixtures clean.
23. Throws bloody towels at once in hopper in cold water.
24. Prepares all specimens for the laboratory, marked with names of surgeon and patient, ward, date, and tentative diagnosis, particularly from *right and left ureters in cystoscopic work*, a matter of life or death to the patient.
25. Does not remove the specimen basin till the surgeon orders, so that he may study his work.
26. Places various sizes of sand-bags under neck or by limb as ordered.
27. Turns tonsil cases on side to bleed in pail as re-

quired, and slaps on ice towels to relieve hemorrhage and restore consciousness with good circulation.

28. Telephones to the ward to arrange for
    Gatch bed,
    Stimulation,
    Murphy drip.
29. Writes orders in the ward order book at the dictation of the intern.
30. Keeps all sorts of work hustling behind the scenes,
    Washing gloves,
    Running sterilizers,
    Linen soaking,
    Sorting covers.
31. Drops
    Acetanilid,
    Aristol, or
    Collodion

on a wound in an aseptic manner, wiping off the container with damp bichlorid cloth, and winding sterile towel around her right arm (Fig. 2).

32. Shaves emergency cases or those improperly prepared.
33. Finds additional instruments required.
34. Applies bandages.
35. Produces smear-glasses, slides, culture-tubes, and swabs as needed.
36. Washes and boils those special instruments which a surgeon wishes to take away with him (if the suture nurse has not time) while he is in the shower-bath.
37. Waits upon the surgeon, if he gets a squirt of blood or pus in his eye, with boric acid and argyrol, and if he jabs his finger in a dirty case, with carbolic acid and alcohol, or with iodin.
38. Records the amount of catgut or the number of gloves used, if, as some institutions do, it is charged to the patient.

39. Keeps empty covers collected and sorted in their various baskets, ready to be refilled.
40. Bed-pan is required sometimes, and must be in readiness, with cover and sponges for cleaning parts.

Fig. 2.—Dusting aristol on a wound.

41. After pus case, disinfect linen before putting down chute, for protection of all patients and employees. Wash furniture with soapy water, then

disinfectant. Wash and boil separately all instruments, gloves, and basins.

42. Kelly pads are soaked in disinfectant after every case. Two at least are kept working. Some surgeons think they are never "clean," *i. e.*, germ free.

The Engineer as Instructor.—He personally instructs and supervises the work of the nurses in frequent visits regarding

Lights, switches, fuses,
Valves, stopcocks, petcocks, faucets,
Cold coils, water-jackets, steam-jackets, filters, gages,
Foot-treads, sprays, soap-holders,
Traps, waste-pipes, flushes,
In gas, water, and electricity

based on notes drawn up by the supervisor. This will result in perfect working of all appliances if the nurse is led to feel that he has authority, and this he certainly should have owing to:

The possibility of accidents of serious nature,
Difficulty and delay in repairs,
Peril to other parts of the house,
Enormous costs in engineering department due to
Its being a profession in itself,
High scale of wages,
Delicacy of parts of machines.

Changing Cases.—Rehearsal is necessary with the new pupil in order to establish a system that has speed and smoothness. The suture nurse near the close of the first case begins to get ready for the second, sending out what she has finished with in two classes:

(*a*) To be used in the next case, washed, and boiled.
(*b*) Not needed again—put to soak.

1. Instruments of different men or for various operations are
Grouped in separate basins, tagged if necessary.
The new pupil should keep her mind entirely on

her work, to form grooves of association of objects with their owners, and the purpose for which they are used.

Fig. 3.—Offering a glove case.

2. The orderly mops the floor.
3. The circulating nurse washes the table with soap, then carbolic acid, if it is to be left in position, then spreads it with sheets, etc.

4. She removes used solutions and basins.
5. She waits on the clean suture nurse,
   Opening packages,
   Removing pins,
   Adding to the stock,
   Replenishing the scrub-up stand,
   Getting basins p. r. n.
6. She waits on the surgeon and his assistants.

There is nothing so thrilling or so completely soul-satisfying in all the work of the operating room as the quick, clean, smooth turnover of a number of cases in a big clinic with one surgeon.

Special Notes . . . Addenda:

1. If dressing covers are frequently laundered, they last longer, and are more suitable for holding sponges.

2. When tying a doctor's gown she thinks with her outer clothing. The nurse touches only the tapes.

3. All packages are carried well out from the body, never under the armpit; similarly when offering (Fig. 3).

4. There should be a carefully compiled book of house rules in every hospital, consulted often by everybody.

5. The circulating nurse should never be absent when needed; she must project her attention into the amphitheater, mentally following procedures there, when she is outside timing the boiling of a forceps.

6. She should be able *to perceive* with her skin, her clothing, her back hair, or to have a sixth sense to know how to avoid touching a sterile surface, or report when wanted.

7. Water that is too hot makes a surgeon indignant. Water that is too cold shocks a patient. To avoid this, read rules and use thermometers.

8. A surgeon sometimes uses a sponge as a plug or for backing in a vagina, and if asked to remember this, the circulating nurse must charge her mind with it. It is an honor.

9. The circulating nurse must keep looking for something to do.

10. Plenty of brushes dry sterilized obviate the difficulty formerly found in boiling so many kinds of things between cases.

11. It is very essential to have a large number of binders of assorted sizes and well ironed.

12. The solution in arm-tanks is changed for a new operator, but not for one man unless the last is a pus case.

13. Safety-pins should be stood in rows on their points around the edge of Castile or Ivory soap as a lubricant for quick work.

14. Dermoid cyst, fetus, or other solid specimen is saved as a routine and preserved in 4 per cent. formalin. Priceless specimens have been carelessly thrown away. An eye should not be put in alcohol, which shrivels it.

15. The pail below a tonsil case helps show the amount of bleeding.

16. Doors should be kept closed.

17. By being all eyes and ears the circulating nurse can make a shrewd forecast of what is next needed.

18. It is pleasing to win the respect of surgeons by applying good bandages—most of them have lost hope in the nurses for that.

19. In certain laparotomies the surgeon slits the culde-sac of Douglas, and passes down an iodoform gauze strip, which the circulating nurse, wearing a glove, catches in the bite of a sterile uterine dressing forceps. This glove must be ready. The nurse requires a lesson by charts and drawings on the anatomic relation of the bladder, vagina, and rectum.

20. A small bunch of twigs or a flat wire egg-beater is good in whipping out the fibrin of blood-clots when searching for specimens.

21. Garbage cans and similar utensils should be operated by a foot-tread, not by the hand.

22. The nurse must wield the mop in an emergency.

23. The nurse must be very meticulous about personal hygiene, bathing twice a day if necessary, wearing dress-

shields frequently washed, and no perfume or scented powder. The hair is washed often.

24. The stretchers must be kept warm, clean and dry from a table stocked with adhesive, binders, dry shirts, and sheets.

25. If a patient swallows ether by the esophagus route, and thus dilates his stomach, the anesthetist calls for the lavage tube, inserts it, and elevates the open end, through which the ether escapes, and the patient may then be regularly anesthetized.

26. The circulating nurse early is taught the contents of instrument cabinets, which are arranged per schedule:

(*a*) Owned by certain surgeons,
(*b*) Classified types of surgery—eye, ear, gynecology, etc.,
(*c*) Steps in each operation—incision, clamp, ligation, etc.,

so that she may easily find a special article when needed during an operation.

27. The circulating nurse should sit when tired, for conservation of strength, till she is gradually inured to the hardness of the flooring, which lacks the resilience of those on the wards.

28. When the anesthetist is covered with a sheet he must be specially assisted in small ways, *e. g.*, in a hare-lip operation, so that he is not smothered in his own CO_2.

29. Summary of treatments for shock or hemorrhage or danger of death from other causes:

(*a*) Elevate feet,
(*b*) Hypo. ordered,
(*c*) Heat (water-bag and blankets),
(*d*) Hot towels to exposed intestine p. r. n.
(*e*) Air,
(*f*) Oxygen,
(*g*) Intravenous infusion,
(*h*) Hypodermoclysis,
(*i*) Cessation of operating—clamps and ligatures only,

(*j*) Possibly more ether,
(*k*) Artificial respiration,
(*l*) Scientific massage of heart muscle,
(*m*) Rectal speculum, dilatation of sphincter,
(*n*) Transfusion.

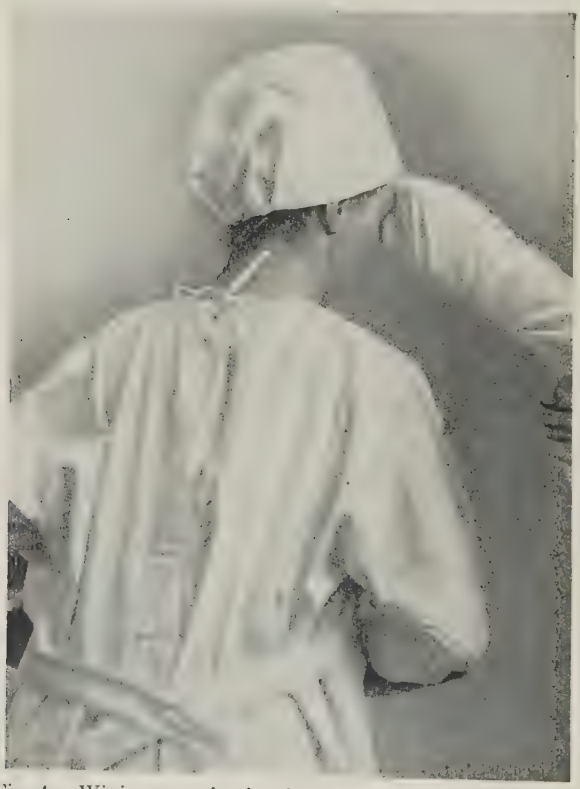


Fig. 4.—Wiping perspiration from a scrubbed nurse's brow.

30. When wiping perspiration off the brow of anyone who is scrubbed, the circulating nurse "makes a long arm" to it, wound in a sterile towel (Fig. 4). This has become less necessary since masks are in vogue.

Sponge Count.—Reasons pro and con:

Pros.	*Cons.*
A check on the surgeon, who in haste and preoccupation might leave one in the deeper cavities.	Delay to a patient when a discrepancy is found is unpleasant, an added duty for the busy circulating nurse.
Ensures more care and observation in the surgeon and his assistants, so that they cultivate the habit of not leaving small sponges free.	She is blamed, when the mistake may be with the person who filled the dressing covers. Carelessness in another place not recently is hard to trace.
Ensures concentration on her job by the pupil.	Possibly the pupil is so busy on such details that she cannot see the woods for the trees, and misses the more important lessons from the progress of the case.
When the sponge count is reported *not O. K.* the surgeon may be right, and the missing sponge may be found under some one's shoe, etc., proving the value of the system.	It looks like dirty work to pick bloody sponges out of a pail, no matter how long the forceps are.
A trap may be set for each new circulating nurse, by the surgeon's wilfully withholding one or more sponges when he asks for the count, thus testing the honesty of the nurse.	The percentage of times that the sponge count is reported *O. K.* is so very large that it seems to some not worth while to have it.
Honor at close grips with a patient in dangerous condition is highly essential.	It requires the attention of the suture nurse to count the sponges as she opens the covers or drums.
A slip with the name of the nurse who packs the drums might concentrate her attention on doing it carefully.	The penalizing of nurses for error is reduced to a minimum in these days for everything, and this type of error is no more serious than a falsehood about a Murphy drip.
	Honor is essential toward one's patient at all times, no more for one than another.

It is interesting to note the manner in which an institution changes its policy. For ten years an operating room runs smoothly without a sponge count, then a sponge is left in a patient, who dies. After this for ten years more the sponges are all counted, till all fears are lulled to rest and the count discontinued. It must in any case be the policy of the majority, and evolved after due reasoning together, under the ægis of the American College of

Surgeons. A blackboard is often used, also a rack on which to hang tapes by rings.

Washing Sponges.—Bloody probangs require long soaking in cold water in a hopper, after being huddled out of the operating room in pails, following the count. To soak articles thus prevents a hopper from "working," *i. e.*, free use by all for varied purposes. To launder these sponges properly demands their being handled seven times more, or eight times in all, at least. Suppose eighty sponges were used. These are made at the rate of sixteen to the yard. This means five yards of gauze which the hospital can buy at less than 4 cents—20 cents at the most. It is false economy to ask a pupil or a graduate who is worth at least 50 cents an hour or a laundryman with a costly machine, at much more cost than this, to spend two or more hours in these frequent handlings of material that costs only 20 cents. Further, the laundered gauze requires much pulling and raveling to use again in surgery. It might be sold for rags. Nothing should be washed, but it is a very unwise thing to avert the destruction of sponges, which may carry syphilis, gonorrhea, other blood infections, or pus lying latent in the person up for operation. The cost of disinfectants and the time required by laborers very highly skilled in other fields to salvage this messy stuff and bring it back to scratch, where the new gauze starts, are too great for a shrewd head to approve of. By the common household methods of laundering, a steadily working woman could not earn her keep ($4.00 wages, 50 cents lunch, and 10 cents carfare = $4.60) keeping up with a suite of operating rooms, and having all the sponges dried and pulled by 5 P. M. ready for making again; $4.60 ÷ 4 cents = 115 yards gauze = 1840 sponges, representing at least 10 major operations. Few operating-rooms use 115 yards per day. *Reductio ad absurdum* (*et ad nauseam*).

There is no doubt that tape sponges should be washed and used again because the labor of making them render it worth while, also the amount of gauze in each.

CHAPTER III

THE ANESTHETIC NURSE

Definition.—The anesthetic nurse is the pupil on second shift in the operating room, waiting on the patients while they are taking ether or gas, to differentiate from a nurse anesthetist who is a graduate being or having been trained in giving anesthetics.

Instruction.—In the anesthetic room the supervisor must demonstrate very carefully, using the pupil as subject, for several days before she changes from circulating to this service. "Put yourself in their shoes" is a safe slogan for pupils in relation to patients anywhere, but particularly in the operating room, where, unfortunately, entities are forgotten. When the pupil demonstrates before the supervisor, the subject used should be the fattest, clumsiest, stupidest person that can be found, in order to stage some of the difficulties bound to arise during the stage of excitement, due to

1. Patient's weight,
2. Disease, deformity, or lesion,
3. Fear of anesthesia,
4. National temperament and habits.

The supervisor lays down the following general instructions:

1. Obtain plenty of assistance:
   Orderly,
   Restraining bands.
2. Take time to place the patient properly, but learn and practice beforehand, not to detain a busy surgeon.
3. Report to surgeon when anesthetist requires.
4. Do not allow anyone to throw himself across the body of a struggling patient, having his lesion in mind, *e. g.*, a fulminating appendix.
5. Avoid bruises or jars, as the flesh is unduly sensitive when anesthetized. Unaccountable bruises caused hospitals ill repute for years.

Positions.—In all positions a small sheet, folded to 6 inches wide, is looped around each elbow and tucked under body.

(1) *Dorsal:*

Patient flat on her back, from head to heels.
Hands are always laid flat under buttocks.
Knees may be sharply flexed, with heels on level with hips.
Used in general surgery.

(2) *Kidney:*

Modification of same.
Patient lies on her face, arms above head.
Cylindric inflated rubber bag under abdomen to push up kidney. (A badly placed kidney rest delays the operation, lengthens the anesthesia, annoys the surgeon, and possibly chokes off the patient's respirations; also if the arms are under the body, temporary paralysis may ensue.)

(3) *Sims:*

Should be learned previously on ward in giving enema.
Remove pillow and lift patient to her left side.
Left knee drawn up toward chin, so that left thigh is at right angles to side of table.
Right knee drawn up much farther—this opens rectum and vagina—abdomen pendant.
Hips well over edge of table to soften the parts.
A real Sims' table has an extension on the side for the feet.
Left arm is gently withdrawn from before breast, and brought in a downward sweep behind her, at the right edge of the table.
Her chest is flat on the table, and her face turned to the left side of the bed, her right arm curved over head.
Sand-bags to immobilize.
Used in gynecology and obstetrics.

(4) *Lithotomy:*

Patient lies flat on the table, drawn down with the Kelly pad underneath, so that hips are beyond the break in the table, and when the foot is dropped the buttocks hang *over the end.*

Apron of Kelly pad breaks at proper place.

Each foot is hung in a stirrup passing

(1) Behind the heel (tendo achillis),

(2) Under the arch.

(Screws of stirrups must be kept well oiled, to work easily, and be frequently tested before operations.)

Stirrups have a special conspicuous place in room, to find easily.

Surgeon must not be irritated by having to ask always "to bring the patient down a little farther."

Arms strapped, and hands flattened under buttocks.

Bars must be well nickeled and rustless, also lubricated.

Used in gynecology, rectal and genito-urinary work, also for breech cases in obstetrics. All soft parts must be free from pressure and relaxed.

Stirrups should throw legs farther apart, to give operator room.

(5) *Knee-chest:*

The patient is not anesthetized. She kneels on the table, so that when the foot is let down her buttocks are vertically above—face down, turned slightly, knees at breast—support given beneath her abdomen by nurse.

Used in cystoscopy, rectal work, and convalescent obstetrics (counteracting retroverted uterus).

(6) *Trendelenburg:*

When gynecologic work is required Trendelenburg may be most frequently expected, and prepared.

The knees must be about 2 inches below the joint in the table, so that when the foot drops the bulk of the calves finds room in the right angle formed.

The limbs are securely pinned in a small heated woolen blanket about 1 yard square, *brought around from behind* them, caught up at the feet into the pocket and pinned in front.

The shoulders are set against two shoulder props, which must be newly and fatly padded to prevent paralysis of the trapezius muscle. Fitting them on the table properly requires study.

The modern table is wound up or lowered by the anesthetist, and he should insist on lowering it, if the patient "goes bad."

Used in gynecology for deep pelvic work.

(7) *Sitting:*

For eye or tonsil under local anesthetic, or for neck, use dorsal, with head of table raised half right angle.

(8) *Gall-bladder:*

Put pad under back, on right side to force liver out under lower border of ribs.

(9) *Pinioning Children:*

Use a very large face towel or small special oblong sheet. Lay the child on the towel, at the hips, long edge horizontal, and pin up the front.

Pin the child's sleeves in front, or at side, folding arms, or straightening. Then reverse towel, to the head. Make darts of equal size on the shoulders to make it snug.

Suitable for staphylorrhaphy.

Methods with Tables:

A. Fixed:

1. Many operating-room suites have rooms devoted each to one purpose, eye room, eye table, etc., fixed.
2. Others have fixed tables with various attachments to suit all different types of surgery.

When the table is fixed the patient is anesthetized and brought in on a stretcher, necessitating lifting.

B. Movable:

1. If a surgeon has invented a special table, he wants it, and though another good table is a fixture, he chooses a smaller room, with his patient wheeled in, draped, all ready. It reduces the number of liftings.
2. The table may be run directly to the patient's room for her and to bring her back.
3. To have several tables facilitates running off a big clinic smoothly, from the nursing standpoint.
4. The patient is ready on her own table, and does not rush the cleaning of equipment previously used.

C. Combination:

Fixed and movable (see Jour. Amer. Med. Assoc., September 29, 1923). A very clever device has been made in Philadelphia recently, combining all the advantages of both fixed and movable tables. In the operating room is a fixed stand (pedestal or legs) with removable top. The stretcher carriage is built to receive or discharge this top. Both table and stretcher bear on top tracks with grooves, and in direct alignment. An interlocking device prevents them from going apart when brought alongside. The patient is anesthetized on the stretcher, wheeled in beside the table base, both are locked together, and by a mere touch, the top slides over in the grooves of the table base. This is reversed when the case is finished. One table, one stretcher carriage, and two tops (litters) are enough to run off a big clinic smoothly.

Setting Up the Anesthetic Room.—The anesthetic nurse sets up her room for a clinic as follows:

Apparatus

Gas-oxygen set (Fig. 5),
Inhalers,
Tripods,
Face masks,
Cones made from towels,
Vaselin for rectal tips,
Cold cream for face,
K. Y.,
Soft straps for knees as restraint in cocain and gas-oxygen,
Hot-water bag,
Lifting:
  Cloth stretchers,
  Sheets.
Ether,
Chloroform,
Cocain,
Novocain,
Quinin and urea,
Pins:
  Straight,
  Safety-,
    In soap, all sizes.
Jack knife to open cans,
Waste baskets,
Pus basins, one high wall
Several sponge forceps
Tongue clamps (Fig. 6),
Tongue sutures,
Mouth-gags (Fig. 7),
Oral screw, etc.
Bed-pan \ with
Urinal / covers, for nervous patients,
Bandage scissors,
Lavage set,
Pocket light,
Nurse's wrist watch,
Pulmotor (Fig. 9).

Stimulation

Means to heat.
Hypo syringe and sterilizing outfit, morphin, atropin, strychnin, digitalis in modern forms, whisky, brandy, camphor in oil, emergency Greeley units (small glass tube showing the dose specified on a legible printed slip, with a fixed needle, ready protected with sterile cover, and soft compressible tube [cold cream type] which forces, when squeezed, the fluid through the bared needle).
Large assortment of drugs and doses of these.
Files coming with ampules must not be lost. The contents of an ampule are easily drawn from a sterile spoon into a syringe, if thick.
Speed and accuracy are two potent advantages with ampules and Greeley units.

Dressings

Eye protectors,
Sponges,
Mouth wipes.
Bandages of all widths:
  Muslin,
  Gauze,
  Flannelette.

Stationery

Pen,
Ink,
Scratch pads,
Anesthesia slips.

Garments

Binders:
  Scultetus,
  Perineal, M and F.
Chest blankets.
Caps of
  Rubber,
  Towels (Fig. 8).
Foot blankets,
Large blankets,
Sheets,
Medium and large towels,
Triangles, unsterile.

To speed the work there should be a standard number of all of these, constantly replenished. At a glance one can tell how much has been used.

Fig. 5.—Gwathmey gas-oxygen apparatus.

Needs of the Nurse Anesthetist.—She usually uses the nurses' dressing rooms, therefore her caps, gowns, etc., are to be laid out there. Her upper garment is a loose

short smock, in the form of those worn by peasants, with a belt, to which are conveniently clamped the gag, tongue-clamp, and sponge forceps. Wrist watch and cap, white skirt and small mask for special cases, complete the costume. These garments are not sterilized. A good anesthetist does not call the nurse from her numerous duties if possible.

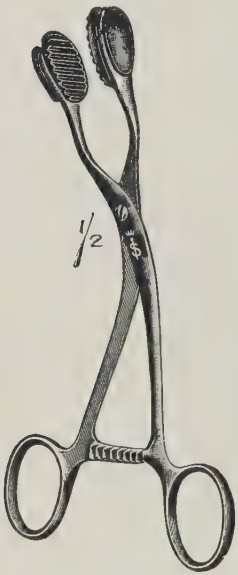


Fig. 6.—Tongue clamp with soft-rubber tips.

Fig. 7.—Mouth-gag. Oral screw, hard rubber or boxwood.

The Rights of the Patient:

A. *Safety:*

(1) False teeth,
Loose teeth,
Crowns,
Bridges,
Might cause choking,
Must be removed and labeled and laid away in a safe place, if forgotten on the ward, being very costly and difficult to get.

(2) Hairpins,
False hair,
Jewelry,
Artificial limbs
Must be removed and kept, as they might wound the patient, be lost, or obstruct the operation.

Fig. 8.—A serviceable "ether" cap for all purposes.

(3) Wedding ring may be tied with half-inch tape, one knot in the ring, one at the back of the wrist, and one below the palm.

(4) Voiding urine must be carefully watched for, due to nervousness or the sequelæ of old scarlet fever, or to the long wait. A full bladder is dangerous because:

(*a*) It is unexpected and rips if barely touched with scalpel or scissors.

(*b*) Free urine in the abdomen is a poisonous foreign body, retarding or preventing recovery.

(*c*) The bladder wound itself heals very slowly.

If the patient has not voided before the anesthetic, this is *reported to the surgeon verbally* by the anesthetic nurse even if it is charted.

(5) Chilling may happen, due to opened pores, hence chest blankets. The gown is loosened at the neck to permit distention of the blood-vessels during the period of excitement. Do not cover the eyes till after the noise of filling the gas-bag subsides. No delay is permissible after this.

(6) The patient must not be left alone one second.

B. *Consideration.*—The whole family of a patient is under strain while the anesthesia lasts. They should be patiently and kindly treated, especially as doctors and nurses themselves make most difficult patients. The nurse and others should be calm, quiet, and kind, with a cheerfulness belying any doubt of the result. The anesthetic nurse may be the last person the patient will ever see. To all persons the loss of consciousness is the big thing, not the operation itself, hence the effort of professional persons to be operated on with local anesthesia. The fact that patients are anesthetized as routine in large numbers should help a nurse to develop that side of her nature, and not make her callous, noisy, and indifferent to details. The orderly who brings up the stretcher must disappear and go on with other work. He may be called

during the stage of excitement and again in taking in the patient, but the woman should not have cause to fear that he would be present when she was draped. Spiritual consolation should always be accorded a patient before the anesthetic if required, especially for the benefit to the staff through the patient's peace of mind. The patient must not be exposed at any time, except the operative field. The cap on the head is well pulled down to mask identity in transit, because all one's looks vanish. In whisking off soiled sheets, a blanket is first laid above all. The handling is done as if the patient were conscious. For their own sakes, nurses must handle patients modestly, as well as for the onlookers.

Lifting Patient Skilfully.—The nervous patient prefers to climb from her bed to the table, in her own room, because the finality of the gesture is comforting. In transferring from stretcher to table, or from stretcher to bed, the rules are:

1. Anesthetist lifts head and shoulders, watching pus basin also.
2. Anesthetic nurse and orderly lift hips by means of small stretcher sheet.
3. Circulating nurse lifts feet, and frees arms from arm guards.
4. In ward, ward nurse should kneel on bed to receive patient, if necessary. This reduces her own body strain from the width of the bed.
5. The anesthetist is in charge, and, to secure unison, he counts "one, two, three!" and, on "three," all lift together.

Great care must be used after bone-plating or transplantation.

The supervisor should have a recognized authority to break in the new anesthetists to do their share of lifting. In transit, the patient's arms must be watched, especially at doorways, and the best way to protect them is:

1. To pin cuffs together over chest, or
2. To flatten the hands under the buttocks, and

3. To bind securely with a large *blanket, brought up from beneath* the patient.

4. Arm guards are used on the operating-tables.

Problem.—Should nurses administer anesthetics?

1. *Graduate Nurses.*—The small and ever-shrinking ratio of medical students to the population is alarming at present. The moral, educational, and financial requirements are high. The austerity of the life of devotion is tremendous. Fewer men are found who have the first and accept the second. This is one cause for the employment of graduate nurses as anesthetists. However, it is only robbing Peter to pay Paul, because there is a shortage of nurses to give bedside care, and the graduate who gives up private duty to administer anesthetics is not vacating a place that another will fill, but probably only wishes to get away from the disagreeable features of some private cases. It is a vicious circle. The causes arise in the modern way of living. These conditions emanate from society, and only by a thorough purging and cleansing of society can a cure take place. By restoring discipline to the schools and the homes, by establishing self-denial, quietness and self-control, by insistence on universal labor in a useful form and abolition of non-essential jobs, the balance of society will return speedily. Nurses do not require the same salary as men, who look forward to maintaining a home and office, therefore a nurse anesthetist gladly accepts a staff position at a fixed salary, with maintenance, and gives full time service. However, the prospect of a long service with desirable living conditions and noteworthy increase of salary is small. But the time of preparation is short, the responsibility slight, since there must be a doctor in charge of the department, and the escape from the bedside care most welcome, No nurse can honestly claim that she is a capable anesthetist, although she may never have had any accidents, because she has not been tested out under all conditions. The nurse studies a very meager outline of anatomy and physiology. She cannot really know the processes caused

by the inhalation of gas, ether, or chloroform, in the nervous and circulatory systems. She cannot order a hypo, or other form of stimulation, nor examine the heart and lungs beforehand. She has doubtless a quicker intuition, deeper sympathy with some patients, and of course practically no interest in the surgical procedure except correlated to her own job. However, before a jury, no matter what the law, the case of a hospital presents a more favorable aspect, when a patient died under the anesthetic administered by a doctor than if by a nurse. The policy of a hospital employing graduate nurses as anesthetists should be clearly stated in its annual report, so that the public might know what to expect. In such matters of life and death, the option must always be given the public. It is possible that, while a nurse gladly takes a position as anesthetist at $100 per month and maintenance, the rate charged by the hospital to the patients, ranging from $5 to $15, is sufficient to net the institution a tidy balance to its credit. The presence of nurse anesthetists calls for special tact in the operating-room supervisor, in adjusting their relation to the pupils, whom it is hard for them not to order about. The constant impinging by nurses and others on the outlying fields of medicine is one cause of the condition first mentioned, the decrease in the number of physicians as compared with the needs of the population.

2. *Pupil Nurses.*—The pupil nurse must not be exploited, by being allowed to give even a few drops of chloroform to an obstetric case. The last drop is the one that killed. To be, all through one's training, horror-stricken or calloused from a death is too big a risk. A practising physician can always be found, if not an intern. The bedside care of patients is probably shirked where nurses are moved out of their place to give anesthetics, examine urine, etc. Anesthetics do not come under the curriculum provided by the legislature for nurses. Nurses themselves would not want it if being operated on.

Oxygen for Stimulation.—This may conveniently be

stored in small tanks lifted with one hand, and standing in low tripods like the nitrous oxid tanks. Large oxygen tanks are a more sure reserve, but can only be rolled from place to place (first removing the fixture). To administer oxygen properly is not difficult, but it is the source of many mistakes that can be avoided.

1. *Gage*, bought at any instrument house, screwed on, when the nozzle for the fixtures is taken off—a dial, which, when opened, shows how many pounds' pressure remain in the tank. All oxygen tanks in the hospital should be regularly tested, and there should be a fixed number of full tanks in reserve in a fixed place, according to the bed capacity of the institution. *The oxygen weighs nothing.* A pupil can tell by no means but the gage whether a tank is full or empty, without wasting gas. But it expands with a pushing strength of 250 pounds in the largest size for hospital consumption.

2. *Fixtures.*—On the tank hangs a bottle of clear glass containing water which must be constantly changed to be fresh and clean. Through the rubber cork go two bent glass tubes. The tube running down the lower *must be under water.* It is the one connected with the tank, and the oxygen must be forced through this water because:

(*a*) A leak can be detected when the tank is not in use,

(*b*) The gas is moistened and rendered more fit to breathe,

(*c*) The speed of the flow in administering is regulated—at the rate of *three visible bubbles* uniformly showing.

The shorter tube is connected to the patient. If this is reversed, the water will be blown all over the place and the gas wasted.

3. *Cost.*—By applying the gage before and after administering oxygen, the amount may be estimated and charged to the patient.

4. *Mouth- and Nose-pieces.*—A small catheter of rubber well lubricated except in the eye, or specially made flat

black rubber tips which fit the nostril, are best for stimulation. A rectal injection needs a black enema tip. These fixtures must be washed and disinfected so as not to transmit the pneumococcus or tubercle bacillus. The funnel method is not effectual, as can be shown by a lighted match, flaring up with intensity because the gas rises to the ceiling.

Special Anesthetics.—A. *Spinal anesthesia*, perhaps not more than a dangerous, fascinating experiment, requires a special outfit. The strictest asepsis, if such can be, is needed, on account of tapping the cord and injecting a foreign substance. With private patients the surgeons have their choice of anesthetic depending on their diagnosis. The cost is borne by the patient, usually. With ward patients, no fads are allowed, and the scope of this department is determined by the medical board with whom rests the credit of the institution. An error in the choice of anesthetic should lead to a careful investigation. Spinal anesthesia is an exact duplicate of lumbar puncture as far as the preparation goes. The fluid to be introduced (without any force but gravity) is a chemical substance, innocuous to heart and kidneys in the normal individual, while chloroform is injurious to one and ether to the other, in many cases. Hence this substance, stovain, was chosen when it seemed unsafe to use the others. A small sterile glass is used into which are emptied the ampules of stovain, whence it is poured into the glass tube specially made, graduated, for introduction into the cord. This procedure usually takes place in the operating room, though the anesthetic nurse attends the physician anesthetist, who is chosen for an added skill in lumbar punctures. The patient is stripped to the waist of his loose operating garb, and sits on the table, leaning forward, with his arms resting on the shoulders of a shorter person standing close to him, so as to bow out his back at the lumbar region. The area is cleansed with iodin and alcohol, then the spinal fluid drawn off. It is not required for examination or measurement usually. To the same needle is connected the stovain tube, held very

close and low to show the presence of spinal fluid, to which the anesthetic is now added, without introducing any air, then the tube is raised to a normal position. The patient's eyes are covered. His sensation is tested from the toes up to the point selected for incision. When complete anesthesia up to the desired point is obtained, the patient is laid on the table in the position indicated, and the operation begun, during which he can converse freely with the surgeon, who asks frequently about his sensations. Sometimes this anesthetic has proved fatal, while in other instances it has been ideal. Syringes must be very thoroughly cleansed with cold water after containing human serum, which, if cooked, ruins their smoothness of action.

B. *Rectal Anesthesia.*—The Gwathmey enema is given by the anesthetic nurse, at an exact moment, co-ordinating with the surgeon's preparatory moves. Formula: For every 75 pounds of patient,

Ether ʒj,
Olive oil ʒiij.

This is mixed in an enamel graduate. In a basin, neatly covered, stand

Funnel,
Rubber tubing,
Glass connecting tube with one tapering point,
Large male catheter lubricated,
Artery clamp.

The entire amount is not always absorbed in the rectum. After operation the residue is siphoned off and measured, followed by a flushing with *cool* water and soapsuds. During the operation the patient's face is covered so that he may rebreathe what he eliminates, which promptly begins after injection. The advantages claimed for rectal anesthesia are:

(1) Smoother process,
(2) Reduction of vomiting,
(3) Freedom for surgery of head or neck.

C. *Local Anesthesia.*—This is desirable for eye, ear, nose, throat, teeth, spine, circumscribed wounds for

small tumors, etc., and minor accidents. Variety of opinion about purity and strength depending on the age of solutions renders the tablet method the happier. Each hospital should have its own formulary, covering minutiæ of hypodermic preparation. When a local reliable pharmacy supplies the hospital, its staff may prepare solutions. The surgeon orders a preparation made on a percentage basis, for example, "Inject 5 minims of 4 per cent. cocain solution." Women are, as a rule, not reliable in arithmetic. This weakness is made worse by hurry or strain. Hence the solution should be made for them, so that they may have only to measure the minims. For the sake of the patient, all such things should be foolproof. No supervisor should take it for granted that hypos are correctly calculated. The nurse must solve the problem on paper and get the supervisor's O. K. There must be distinct printed rules about boiling or not boiling drugs. Wholesale laboratories make tablets with strict hygienic care.

I. Cocain comes under the Harrison Law in New York State, with which nurses should be familiar, therefore it should be framed in every corridor. This drug is smuggled in enormous quantities and introduced to young school children so as to form the habit early. Nurses should study this social menace and throw themselves heavily on the opposite side, proving by example that they realize and try to offset it. For example, after a minor operation in a home, where the drug is paid for by the patient, the nurse should show the unused portion to the doctor and destroy it. He is not entitled to it, because he has not to report to the state for what he does not buy. She is not entitled to it, because she did not pay for it and is not obliged to provide any drug at any time. Cocain should be not only limited but abhorred. The operating-room supervisor should not resent having to travel for her supply to some central distributing point, such as,

(1) Superintendent of nurses,

(2) Pharmacist of the hospital,

as these are the only persons holding licenses whom the law would permit to hold it. There should never be an *atom of cocain left lying about.*

II. Novocain is a synthetic preparation, not habit-forming and not related to cocain, though the name was made on account of the similarity in anesthetic effect. It is less toxic than the other substitutes for cocain. When injected, it exerts a powerful, prompt, but not sustained anesthetic action, which last may be remedied by the addition of adrenalin just before injecting.

III. Quinin and urea hydrochlorid may be used in "anoci-association" in combination with novocain, thereby diminishing the required amount, and, consequently, the ill effects of both. It may be purchased in ampules. It is very satisfactory following operations for hemorrhoids or fistula in ano.

General History of Anesthesia:

Dr. Crawford W. Long gave ether in Georgia, 1842.

Dr. Wells gave nitrous oxid gas in dentistry, 1844.

Dr. Morton, Boston, gave ether in 1846, very generally.

Dr. Jackson.

Sir James Simpson gave chloroform to Queen Victoria in 1847 for childbirth.

Classes of Anesthesia:

1. General: Absence of sensation and consciousness (ether and chloroform).

2. Local: Absence of sensation in the site of one nerve only—but patient conscious (novocain).

3. Regional: Absence of sensation in a large portion of the body—but patient conscious—two or more nerves involved (stovain).

Preparation for General Anesthesia:

Standard preparation:

Field of operation and surrounding area.

Intestinal tract—purgative usually the day before, and one low S. S. enema.

Stomach—stomach empty—no solid food 8(?) hours previously, no liquids; 4(?) hours.

Urine—examined.
Mouth—thoroughly cleansed with boric acid.
False teeth, *et al.*, removed.

The anesthetist must make a thorough examination of heart and lungs, as to toleration of anesthetics, and makes a special point of gaining the patient's confidence.

Methods:

I. Open—ether and air mixed, 95 : 5 (Fig. 59, p. 359).
II. Closed—all ether (Fig. 58, p. 359).

To give ether by the open method, use the mask, and the drop method, *i. e.*, one continuous dropping, saturating different parts of the gauze equally—never hurry it—give the patient all the time he wants, *e. g.*, having him count and blow the ether away. A special art is required in handling children.

Three stages:

1. Excitement.
2. Anesthesia suitable for operation.
   Not rigid, but relaxed,
   Not conscious, but capable of coming to soon after ether is withdrawn.
3. Profound narcosis, very deep anesthesia followed by death.

In the first stage the breathing and pulse are irregular, and the reflexes are increased, *i. e.*, the pupils are dilated; muscles are rigid.

In the second stage (the sympathetic), breathing is regular, pulse rapid and regular, reflexes are diminished or absent, pupils are normal in size and do not change on exposure to light.

In the third stage—we do not want to arrive at this stage—the anesthetist should discontinue the anesthetic—the pupils are again widely dilated, and the patient is dying.

Patients must never be anesthetized alone on account of unforeseen conditions in the first stage.

General addenda:

1. Chloroform may produce death by cardiac paralysis. Ether, by paralysis of respiration.

2. Ether preceded by nitrous oxid gas is the more rapid method.

3. Anesthesia is used merely for muscular relaxation for accurate surgical diagnosis.

4. Nitrous oxid causes a condition similar to asphyxia, therefore the breathing must be watched rather more than the pulse. The patient may laugh or cry hysterically afterward, but otherwise has only malaise.

5. Most surgeons for lengthy general anesthesia desire the hypodermic injection of morphin + atropin because: 1, The patient has less excitement "going under"; 2, and is less sensible of pain "coming out."

6. Chloroform and ether are inhaled. Novocain is injected subcutaneously; cocain may be

Painted on—in varying strengths,
Dropped in the eye,
Injected by hypo.

7. The pulmotor (Fig. 9) requires skill and care in cleaning, especially in not confusing the parts and closing off the wrong channels, but anyone can learn to operate it, "for resuscitation of the apparently lifeless from the effects of *anesthesia*, poisonous gases, smoke, drowning, electricity, collapse from any cause. The operator applies the face mask and turns a key, starting the mechanism of the apparatus, to produce immediate and measured respiration, with pure oxygen entering the lungs at each inhalation. The tongue is held forward by forceps, and oxygen prevented from entering the esophagus by pressure with the right hand" (Da Costa, *Modern Surgery*).

8. Pus basins for vomitus should have one high outer wall.

9. When the anesthetist uses a table, it must be set to place at once, and a high stool given him, immediately after the patient touches the table or is wheeled in on it.

10. Ether must not be introduced near a flame, match, lamp, pilot light in gas range, or room containing gas that absentmindedly might be used.

11. Cost is not the factor determining where to buy ether, but quality. Similarly with chloroform. Both deteriorate on exposure to air, and must be bought in containers as small as possible:

(*a*) Ether, $\frac{1}{4}$ pound cans,

(*b*) Chloroform, 40 grams.

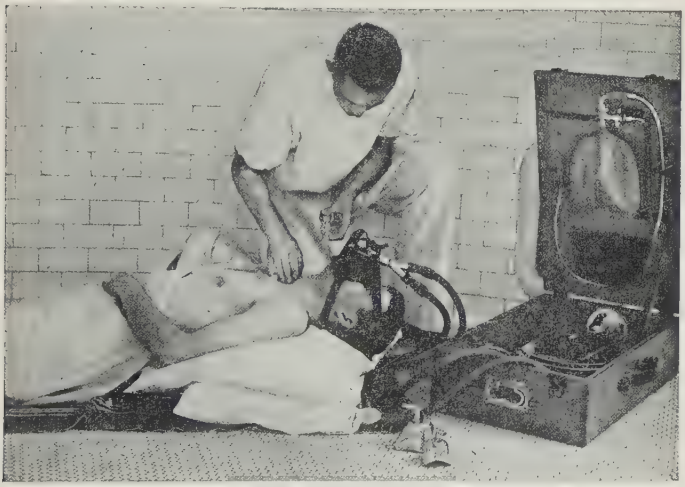


Fig. 9.—The pulmotor.

In *beginning* a new case, the anesthetist should open new bottles.

To *carry it on*, some use the left overs from the day's previous cases.

Otherwise, all left overs may be used for cleaning grease marks, in two stock jars.

12. Chloroform masks may be covered with flannel, because anything more open of mesh will permit drops to fall through and burn. The flannel, being boiled for each using, must soon be removed.

13. There should be strict economy and accounting of both gases, chloroform and ether; none should be taken for personal use. A ratio of the amount used for

Each type of operation,
Each anesthetist or surgeon,
Each anesthetic nurse's term

is worth compiling to induce thrift. The hospital statistician should demand it.

14. Each nurse on this service should keep a record of the types of anesthesia in which she assists, so as to appraise her experience.

15. She watches for hemorrhages.

16. She is taught to sponge out mucus.

17. She administers amyl nitrite p. r. n. by breaking the new fashioned lint tubes or the former pearls.

18. She learns artificial respiration—keeping slowed down to 16 strokes to the minute. A nurse may distinguish herself doing this in an accident or drowning at any beach.

19. She learns how to hold the jaws to prevent a patient from swallowing his tongue—downward and back, practising on the family skeleton.

20. There are odd minutes when the industrious nurse is waiting with her patient for the anesthetist, when she may make hundreds of yards of packing (Fig. 10).

21. Before she is moved up to the third service, suture nurse, she may help clean instruments after cases and learn what each is, how used, and how put together, or may clean those that are taken away by their owner daily.

22. Ether caps may be made from towels (Fig. 8) and put on fresh if disarranged during operation.

23. For gas-oxygen (Fig. 5) and novocain, the patient's knees are strapped to the table with a wide soft band.

24. For goiter operations the head of the patient is lowered and soft pads of fluffed towels dropped in curves of neck to hold up the laparotomy sheet.

25. Gas-oxygen anesthesia is usually charged to the

patient and the nurse checks off the amount if the bill is to be estimated by "pounds" used.

26. The actual isolated task of any one sort is not hard, but the nurse must be ready at all times for an instan-

Fig. 10.—Making packing from a bandage.

taneous complete change of front, with presence of mind which can be cultivated only by trying to foresee what may happen.

Return of a Patient to Bed.—In some systems the anesthetic nurse accompanies the patient to the ward, and goes over her thoroughly from top to toe, to prove to the pupil nurse that she has delivered her unconscious charge in good condition—cap, chest blanket, dry gown, abdominal and T binder, bandages, drains, stockings, general review of skin, pulse, respiration. The chart is brought down with the patient, having a slip fastened to it, containing in red ink the important details of the operation for the *immediate enlightenment of the ward nurse*, who can then proceed intelligently in the postoperative care. This slip is modeled from the following:

Surgeon—Bryan.
Patient—Coolidge.
Operation—Appendectomy.
Stimulation—Strychnin, gr. 1/30 by hypo.
Drainage—Two rubber, one cigarette.
Intern—Jones.

The ward nurse copies this on the chart bedside note at once.

When the patient is put to bed, clean, warm, dry, with positive assurance that there are *no hot-water bottles* forgotten concealed in it, or a rubber drawsheet previously superheated which may cause a burn on the back when sensation is diminished and vitality lowered by anesthetics, the operating-room pupil collects her basins, towels, blankets, etc., and returns to prepare them for the next case (boiling face articles). She should warn the ward nurse about possibility of hemorrhage or shock. Tonsil cases are laid *face downward* on the stretcher (arms above the head, face slightly turned for air) in order to swallow no blood. Some surgeons keep drainage appendix cases on their face also, with good results. The time is well spent in giving the ward nurse all possible information regarding the postoperative condition of each case.

Recovery Room.—This is rather infrequently made an adjunct of the operating suite. If the patient has special nurses, the operating-room staff is not greatly incon-

venienced. If the recovery room has its own workroom, there will be no jostling at critical moments to both staffs, at hoppers and heaters. If the hospital is very small, private and exclusively surgical, the equipment may be planned so as to bulk largely around the recovery room. Noise from postoperatives should be kept out of the range of convalescents. If the hospital is a very large, general private and ward institution, the skyscraper plan is ideal, permitting splendid grouping of cases in stages. The critical postoperative ward case may be dropped one floor only per elevator, to a ward service out of earshot of convalescents, yet sufficiently near the operating plant to get hot blankets, sterile water, etc., quickly. The skyscraper admits of loggias and common windows on all sides of any corridor, so that the private patient retains his room till departure. The ward convalescent may be placed elsewhere. The interns operating may not attend postoperative cases, hence the recovery service is handed to others. There should be a distinct line of cleavage in the nursing service also, since the time of an operating-room pupil is worth vastly more than that of ward pupils. Supposing the recovery room still included in the operating-room suite the equipment following must be provided:

1. *Murphy Drip.*—Protect patient with soft old blankets, four at least, so folded that they break in the center and merely overlap. Fold each in half, laterally, and lay two over abdomen and two over knees. Catch together with two safety-pins. This admits the apparatus and the nurse's hand, without hoisting covers and chilling the patient. The drip should be arranged as follows: tank, source of heat (electric-heating element, bulb, or hot-water bag), drop apparatus (clamp, cord, bent hairpin, special glass connecting tube), tubing in two parts, special thermometer as for infusions, with outer glass tube, to test just before injection, small bit of rubber catheter, solution ordered, plain water, glucose, or saline. Murphy drips given wrongly are worse than useless. Any nurse should be able to improvise and also to demonstrate the

Murphy drip, including the follow-up work of pulse report, perspiration, urine, absorption, residue, etc.

2. *Gatch Bed.*—Of these, any surgical service should have about 50 per cent. of its beds. They are needed for drainage and heart cases. They may be improvised by: Back-rest or straight chair, rubber-covered pillow to sit on, small board under pillow, very long sheet folded diagonally into a sling fastened at the head of the bed frame to make the seat, many pillows of assorted sizes for rest of arms and back, second long sling with folded sheet for foot rest, pillows under knees. All pillows used below chin must be rubber covered. Raise foot of bed an inch if necessary.

3. *Lavage* requires careful report of findings, measuring, etc.

4. *Bladder Drainage.*—Patient lies on face and bed is specially made as follows: Head and foot of a three-sectional mattress used, four thin rubber-covered hair pillows substituted in center, arranged longitudinally, bandaged into position, retention catheter drops down between two pairs of pillows into a urinal tied to the spring. This may be used for helpless fat fracture cases to slip bed-pan in the space required, saving purchase of expensive bed.

CHAPTER IV

THE SUTURE NURSE

"Watching over Israel, slumbers not, nor sleeps."

Problems of the Personnel.—In small hospitals which find difficulty in procuring interns, the suture nurse combines the duties of an instrument passing intern with her own, and actually takes part in the operation, her gloves being smeared with blood, and her hand forming contact with the wound and then with her table, which is, therefore, not sterile. It seems difficult for many to understand asepsis, and we have to believe what they say till we see them make a break, whereas if every person in the operating unit were asked to demonstrate asepsis, the results would be amazing. If a suture nurse receives one instrument from the operator, she should rescrub (with new garments) for another case. If she has absolutely no contact per glove, arm, gown or utensil, with the operator or patient, she does not need to rescrub. Careful statistics may be made covering the suture shift of several nurses to find which is the best of the many methods used. No two hospitals seem exactly alike, and it is these many marked differences which cause acute annoyance and tension during the frequent changes of personnel that fill the history of small hospitals. In the small hospital the number of pupils may be raised to the standard quota just during the hours of operating by drawing from the ward force. The pupil may be taught each step by the supervisor in class with charts, moving pictures, and particularly a little dissection of poultry, etc., in the required region, so as to acquit herself creditably, and so that the surgeon is not aware of shifting personnel unless he peers very closely at her masked figure. If the hospital has a good system of posting cases the night before, the

head nurse can hold a class at 6 P. M. Where a hospital is classed A, and has a registered training-school, there must be in the school all told the proper quota of pupils to arrange the schedule to admit a clean suture nurse. We are interested only in schools of the academic type, which pride themselves in teaching future operating-room supervisors to attend thousands of patients yet to come.

Suture Nurse.—She has fewer but much more exacting duties assigned her than the others. It is the last shift of a hard service, with intense concentration, superheated and humid atmosphere, unyielding floors, sometimes unpleasant dovetailing into the tasks of others, with the immense responsibility of life and death. A nurse in this position must save herself, keep good hours, wear suitable shoes, and attend closely to personal hygiene and diet to maintain stout resistance and a clear head. Her every act is under close scrutiny. The surgeon will decide if she has the makings of a future supervisor. Onlookers may request her name to file for future use for an out-of-town institution. The pupils will try to see if she makes a "break" in asepsis. She should bear herself seriously alongside a patient that is hovering on the borderline between life and death. She is largely responsible for prevention of mistakes among the rest of the unit. Even a new intern should receive her hints graciously. Routine kills originality, but saves time and gives security. The suture nurse should learn and demonstrate routine procedures so long that the staff feel it is ingrained in her system and then flirt with it once in a while by showing some clever feature to suit a special case, or else "we'll never get on." There should be no conversation except by the doctors. Simple signs are enough to obtain assistance of any sort from the other pupils, few in number, and standardized in all hospitals if possible. The attention of the suture nurse should be focused on the wound and operative procedure, not on any person, then the case will never lag. Orders given for postoperative care, diagnosis, explanation of procedure, indications to the

intern for first dressings, call for stimulation, etc., may then be distinctly understood. Frowns, coughs, agitated hand waving, etc., are taboo. There are many tender points to adjudicate in the field of the scrubbed nurse. No secret numerous caucuses of two will solve the problem. The following are important conditions:

1. A *surgeon* wishing to do superexcellent work may lean heavily on the help from a graduate nurse working constantly with him and instantly anticipating all his wishes. "What's sauce for the goose is sauce for the gander." Any privileges of the operating room which cannot be allowed to *all* ward attendings should not be allowed to *any*. As for *private* cases, a hospital might within the bounds of reason employ a graduate nurse on a regular salary and then charge the patients for her assistance for certain men's cases if they care to avail themselves of her skill. This will dampen the ardor of the type who partake of the nature of that bird, the cuckoo, which lives in other birds' nests.

2. A *supervisor* who is told by the surgeon to scrub for his case, when it is not the custom to do so for all cases, is within her rights to ask as soon as possible for an understanding of her duties. A fresh interpretation is undoubtedly necessary. She may weakly accede to his request if she likes better to be hobbled to a suture table than to be chasing dirt, and correcting nurses, but she is not earning her pay as "supervisor."

3. A *pupil* who is not allowed to scrub for ward cases is within her rights to ask for a readjustment as soon as possible, so that she may show her ability.

4. A *superintendent of nurses* who is asked to judge these cases may ask for a fair trial of the pupil, preceded by proper instruction, on some average cases. Then if the pupil is stupid, one who has already succeeded on the suture shift should be sent back to relieve for that period.

There should be open, free discussion, with all the different factors represented. In professional matters, a Board of Governors can always obtain an unbiased

opinion from some celebrated hospital consultant. When a surgeon accepts the position of ward attending, he tacitly accepts the professional duty of teaching pupils, and he cannot justly debar nurses from scrubbing for ward cases in the routine prescribed, without specified charges that have to be accepted as sufficient by the Training-school Committee if need be. The operating room is manned and equipped from funds obtained by taxation, and chartered by the legislature, both processes based on the best customs of government. Similarly the legislature deputes a Board of Regents to carry on a system of education in this arena. It is contrary to the principles of the systems of America for any one to

Throw sand in the ball bearings,

Throw a monkey wrench in the cogwheels,

by changing the main methods for his personal benefit and trampling on the rights and feelings of others. The other surgeons will feel that this "bloc" is an aspersion on the quality of their work. To withdraw instruction or experience from pupils which they should legitimately expect leads to difficulty in securing good ones in future, hampering the workings of an institution which hopes to reach far into posterity by sound teaching and well-watched corrected experience. There is no more ludicrous public figure than a short-sighted surgeon, who wants the best now, and gives no thought to the quality of the support he is building for himself for ten years hence. It is not conceivable that any man should be so false to his position that he would prefer to make a supervisor lick his boots, cringe, and obey in fear that his aspersions could cost her her position, while the pupil, intrenched in the protection of her school, has no diploma to lose yet, and cannot be badly hurt by his remarks while she is only a learner.

Conducting an Operating Room.—The suture nurse learns now or never how to become a supervisor by watching and assisting in the general management of the operating room. This is done by (*a*) visiting the main offices

with the head nurse, with requisitions, shopping for special equipment with her, reporting losses and breakages, (*b*) relieving the head for her time off, and, if possible, vacations, and (*c*) taking night cases alone (unless the hospital has a full night staff). Costs, materials, and makes of garments should be discussed as a part of daily conversation; at the desk is a spindle on which is placed all information regarding (*a*) stock running low, (*b*) criticisms by the surgeons, (*c*) instruments requested. Business acumen is developed only by doing business and learning from mistakes.

Duties Before Operation.—All dry goods needed are collected on a tray in their covers, and set on a table. Sutures and special appliances called for, *e. g.*, sand-bags, kidney bag, shoulder braces, stirrups, blankets, hot-water bags, are collected and placed on a stand. Instruments are put on to boil the required time, and brought in by the circulating nurse when the suture nurse has scrubbed and covered one table.

Preparation of Skin at Operation.—Tincture of iodin is most extensively used. The strength must vary with the age of the patient—three-quarter strength is most common. Benzine removes grease from the pores, but must have completely evaporated, so that the iodin will penetrate. Harrington's solution is favored by a few, requiring a gauze scrub for three minutes, then a thorough rinse of alcohol, before applying iodin. In hernia cases many use tincture of green soap and water before applying Harrington's solution and iodin. In rectal and vaginal cases, tincture of green soap, water and bichlorid of mercury or tincture of iodin, one-third strength may be used. Irrigations of sterile salt solution are used in rectal cases, or bichlorid of mercury in vaginal. In scrubbing the area of operation, the spot directly over the place of incision should be done first, while the sponge is clean; then it is carried outward, around and away, never going over a spot again with the same sponge, then the umbilicus is done *last* and *alone*, being the most un-

clean. The sponge stick is dropped into a pail or floor basin, whatever is the cleanest floor receptacle from which the circulating nurse bends to retrieve it and boil it. The ward nurse should never send up a patient with a dirty umbilicus. Organisms thrive in the dark and warmth there on account of the moisture not well taken up in the hurried morning dip.

Rules for Scrubbing Up and Setting Up.—The house has standard rules as to

Time,
Extent,
Disinfectants

in scrubbing. The nurse dons her cap and mask, then scrubs, then is given her gown which must have long sleeves, and gloves which go over the edge of the cuffs. For a clinic of 5 cases by one operator, she lays out five times as much enamel and linen material as for one, all at one time, being sure that there are all the unusual instruments needed in unusual cases. When setting out the goods, she wears two pair of gloves, peeling off the outer pair as the surgeon comes in. The only things to be cleansed and returned between cases are the instruments. The folded towels to dry the doctors' hands are arranged in 5 sets of three between layers of sterile towels. At the beginning of the second case the surgeon with wet scrubbed hands comes to the towel table, whisks to the floor the cover, then takes up one, his assistants the same. She pushes covers *from her*, and stands as far as possible from the tables, or from the circulating nurse when bringing in the tray of instruments. The "straight front" learned in maintaining asepsis is the same posture required of a good waitress in serving food.

Carrying on the Operation.—The suture nurse teaches by example, and works by routine not to confuse those beneath her in rank. After the first four scrub towels are clamped into place by the first assistant the suture nurse hands him, by its handle, the sponge stick of iodin,

then one of alcohol, neither of which she takes back. She never receives anything except sterile goods brought in their containers by the circulating nurse. She hands the laparotomy sheet to the assistant, without contact, then the fresh towels with clamps, always having the air of dropping them like a hot potato, to show that she is afraid of touching the operating-table or anything pertaining thereto. She does not assist in draping the patient. She drops scalpel, clamps, ligatures, sponges, forceps, etc., on the small instrument tray, then goes back to her table. She keeps towels hot in saline, offering them when the intestine is about to be exposed. Usually these "towels" are large tape sponges with heavy rings attached. She never touches the outstretched hand of the junior assistant, whose duty it is to give the traditional signs for "probang," "tape," "enough." Watching alertly over the whole field, she is responsible for the entire management of the case, sending for the supervisor when in doubt. When laid on the table in groups by a routine method carefully taught beforehand, the instruments should always form a definite picture of the steps in the operation. As the matter concerned is very vital, all work should be neat and done in a finished manner.

When it is time to sew up, clean towels are laid around the wound, and the bulky instruments are sent out. Sutures are economically cut and counted.

The assistants put on the dressings. One principle is paramount for abdominal work—the laying on of adhesive begins at the pubis to check hernia and proceeds upward (similarly the braiding of the many-tailed binders). "A slight bowing or looseness is added on each strip, not to do away with the pressure for hemorrhage and union, but to take into consideration a reasonably expected distention. All the dressing must be covered with adhesive, so as to permit no gateway of infection."—*Trained Nurse and Hospital Review.*

The suture nurse may proceed to put away clean things no longer needed in their containers—rubber tissue,

tubing, silkworm-gut, etc.—and to lay out the supplies for the second case, in order of use, iodin, sponge stick, etc. It is a great advantage in time saving and smoothness to have her remain clean. She acts like the pivot on which a squad turns.

Changes of Surgeon.—If a different surgeon is posted, there is an entire change. The suture nurse scrubs, dons new garments, and sets up with new table covers. The circulating nurse cleans the table (if it is stationary) and removes all table covers, basins, etc.

Records.—The clerical work relating to a case record should be done by the suture nurse, under the supervision of the head nurse. Data regarding specimens, drains, operator, anesthetist, anesthetic, *et al.*, which might at any time be referred to in study of case histories or in a court inquiry, must be truly and wholly set down.

Specimens.—These are put in the required solution (4 per cent. formalin) and marked with the name of surgeon, patient, tentative diagnosis, dates, and part affected, and sent to a specified shelf in the laboratory by a responsible person. Findings play a large part in demonstrating skill in diagnosis, checking needless or careless operating. They must be included in the patient's chart.

Instruments.—In the best operating rooms usually the instruments are selected by a committee of surgeons. All purchases must be made in a systematic way after rejecting old instruments and hearing special requests from progressive men. The ward attending surgeons are entitled to the best. The committee should keep an inventory and personally audit it at regular intervals. Cabinets should be locked and opened only by responsible persons. The committee, consulting with the supervisor, should aim:

To give good service to all surgeons (within reason),
To have enough instruments to run off big clinics in as many rooms as are equipped for operating,

To keep the whole stock (operating, ward, and obstetric) in good repair.

Instruments should be named according to their purpose rather than for their inventor.

There is a routine channel in many institutions to send old instruments from the operating room to the wards and then to the missionaries. Owing to the large deficit all good hospitals have, it is hardly fair to expect the missionaries to say "Thank you." The suture nurse should collect all instruments for repair, sharpening or renickeling, and pack them for mailing, knives in their boxes which are not to be lost, scissors in last weeks' return of soft paper, and all listed as to:

Length, *maker*, *use*, *number*, and *special repair required*.

One slip goes with them, one is kept in the main office by the bookkeeper as a check, but the original list is made in the instrument book, which must never be destroyed, because:

(1) It is a check on the stock book or inventory,

(2) It shows how certain models stand wear or not.

This collection for repairs includes:

Operating room,
Wards,
Obstetric service,
Ambulance bags,
Accident room.

A ward or other service must not be crippled by sending away instruments; they must be replaced by those from the main operating room and the reserve drawn on for it. Two of one kind need not be sent at one time. The committee only can discard instruments permanently, listing them with their original values, so as to make a requisition on the Board for their equivalent. Books of addresses of dealers are much needed. Catalogs of manufacturers furnish material for interesting and instructive study in their illustrations and nomenclature. The suture nurse should become deft at sharpening com-

moner instruments with strop, hone, or oilstone. She tests all for sharpness, rust, bite, or spring. A drumhead made of the wrist of an old soft kid glove drawn over an embroidery hoop or napkin ring is excellent for testing edges. If it cuts with snappy vigor the edge is sharp. If it saws like dough, it is dull. Instruments after operation are rinsed, boiled, scrubbed with Bon ami, washed in tincture of green soap and water, then rinsed, then plunged in alcohol and dried, and put away in order.

Ambulance Bags.—Unless the ambulance service has its own graduate nurse, supplies can all be unified, and a small stock may go farther by making all of it work, if the bags are sent to the operating room to be replenished and instantly returned, in good condition. The special emergency equipment for them is as follows: Hypodermic set, small oxygen tank, tourniquet, obstetric tape, vaginal and other packing.

Supplies Made by Pupils.—The suture nurse being senior, has charge of plaster work, discussed in another chapter, and dismissed herewith, "Have them right, for if they're bad, they're very bad, and so is the surgeon's humor." A man with a bent arm after fracture attacks the surgeon who set it, who cannot take refuge in "bad bandages." Cutting gauze may be left to orderlies or porters if machines are used. Apportioning piles of gauze to workers outside the operating room requires patterns, counts, and inspection. Rolling muslin bandages, making dressing-covers, and the general cleaning by maids all come under the suture nurse as a learner, while the supervisor is on, and as a charge nurse at such times as Sundays, night, and vacations. In making supplies a huge store of goods sterilized and not, should be maintained, and moved forward to be used, putting the newer away. Sterile goods do not remain so indefinitely. There are four conditions that must be met:

(1) The every-day supply for all services, op., ward, obs., etc.,

(2) A reserve of sterilized goods, on a fixed written standard,
(3) A HUGE reserve of unsterile goods made up as sponges, cotton balls, dressing-covers, etc.
(4) A supply of gauze and cotton, flannel and muslin, crinoline, and outing flannel.

The supervisor should teach that the operating room is ready for anything that may happen, such as:

(1) A breakdown in the sterilizers or engineering department,
(2) An unusual run of pus cases, cholecystectomies, etc.,
(3) An epidemic among the nurses,
(4) A visitation from God, such as the Japanese earthquake, floods, or fires.

Needles.—The points of needles require constant testing, before and after each boiling and when putting away at night. Never boil a dull needle. Never hand a surgeon a dull needle. Keep a large stock (as far as is compatible with the climate). Needles may be threaded with silk and drawn into gauze before boiling, or they may be dry sterilized in flannel. Perforated nickel boxes ($4 \times 2 \times 1\frac{1}{2}$) may be used to boil needles in for safety as to

Number,
Care of points,
Care of nurse's fingers.

Hypodermic needles made of platinum do not cost very much, yet they last forever. Each individual should have his own, especially for anesthesia.

Surgeons' needles are round bodied, full curved, with cutting points. No. 2 is used for through-and-through or for stay (retention) sutures with silkworm-gut or heavy silk. Number 19 is used for cleft palate, with silk or linen, and for a fine skin suture with silk, horsehair, or fine silkworm-gut. It has a patent eye.

Hagedorn needles are flat bodied, with cutting points, and full curved, half-curved, or straight. Number 1 is

used for through-and-through sutures, No. 12 for fine skin work and circumcisions, straight for blood-counts.

Sims' cervix needles are half-curved with cutting points, suited for trachelorrhaphy and abdominal hysterectomy.

Mayo needles are full curved with flat shank, square eye and round point, suitable for catgut in peritoneum and fascia, or wherever a heavy round-pointed needle is needed.

Lister's fishhook has a cutting point, used in the cervix with catgut.

Ferguson's needles are full curved, round pointed, used intra-abdominally in fascia and peritoneum.

Ferguson's taper-pointed needles are for intestinal work with silk, linen, or catgut.

Kelly needles are full curved, round point, long eye, mostly for abdominal work.

Intestinal needles are straight, round bodied, like a common cambric or embroidery needle.

Milliners' needles are somewhat larger, but similar.

Curved intestinal needles are used to advantage.

Emmett needles have a taper point.

Blunt needles are round, full curved, with blunt end, for herniotomy.

Mayo intestinal needles are shaped like a fishhook, and are used with fine silkworm, linen, or catgut.

General Notes on Needles.—Needles are expensive and should be sharpened to use again. They should be counted by the suture nurse before the close of the case, and if all are not accounted for, a search made and all other work suspended. Once out of her hands, the needles may be dropped in a sheet or a bloody sponge. Everyone participating should keep all sorts of goods in place, and pay attention to the faint gleam of any bit of metal or glass in unusual quarters. The suture nurse is responsible for where things aren't. Cutting points are used on tough tissue (skin, cervix). Round points are for delicate parts (eye, intestine), as they tear less. The self-threading patent needle (calyx) has a spring eye where the thread is drawn in from the end.

Sutures (needle and thread) must be studied with care in four ways:

I. Locations:
   1. Head, scalp, face, inside mouth or nose or ear,
   2. Skin—face, hand, foot,
   3. Bone—joints,
   4. Mucous membrane—inner lip, gut,
   5. Deep abdominal—peritoneum, fascia,
   6. Cervix,
   7. Perineum, etc.

II. Future condition:
   1. Absorbable—becoming one with the tissue itself.
   2. Non-absorbable, as catgut:
      (*a*) Never removed—in gastro-enterostomy so as to be sure to hold, as silk,
      (*b*) Removable after a definite period, after union is known to be established, as silkworm-gut.

III. Pattern of stitch—how taken in the flesh, how run in, and how cut, as through and through, running, interrupted, etc.

IV. Material—silk, linen, wire, etc.

The suture nurse, following the operator, must try to remember what he did on a similar previous case, what the supervisor taught in the morning rehearsal, and knowing the point at issue, will judge from rules what she would use herself. By training

Memory,
Judgment by deduction,
Observation

she will not often err.

I. *Locations.*—Location of wound in the scalp means that the needle must be stout, fairly large, with a sharp-cutting point for the tough tissue, and that the thread must correspond in stoutness. The wound must knit securely, on account of the exposure of the part to the elements, to violence and to infection. Hence a non-

absorbable, removable thread, such as silkworm-gut. The nurse can deduce for herself, by applying her knowledge of anatomy. The face must be handled gingerly for the cosmetic effect. In an accident case of this sort, give the patient a mirror to see that his dressing is neat, and after removal of sutures, to show the minuteness and paleness of the scar. There will not likely be strain or human violence, hence a slender thread; there must be no scar, if possible, and we should not destroy needlessly any tissues, hence a fine needle. The nurse gives a round bodied very fine curved needle, with fine silk to be removed. In most cases a straight needle is good on curved surfaces and a curved needle on straight surfaces, outside the body.

II. *Future Condition.*—For deep abdominal work, with no future outlet, *i. e.*, a permanently buried suture, the nurse must perceive that it must not hurt or irritate the surrounding tissues, therefore it should be either absorbed into the tissues or walled off. A deeply buried suture of silkworm-gut will not absorb, but irritate, prevent healing, and cause a sinus. Hence the material offered should be silk, which will not irritate, hardened catgut, or linen, according to the surgeon's preference. It stands to reason that a soft suture made from animals, which becomes merged into the flesh in a few days, will not be so firm in uniting as a stout thread which must come out, and for which the wound must wait much longer. In the perineum which is subjected to great strain at stool, the sutures should be of non-absorbable material, such as silkworm-gut (even silver wire). In deep abdominal work, where irritation is to be avoided, and yet there will be strain, owing to distention or expulsive efforts, hardened or chromicized catgut may do, which is so treated that it cannot merge into the surrounding tissues for ten, twenty, or forty days as labeled. The larger the number, the longer it takes to absorb, and just so much longer time is given the cut to heal. Loose bits must not be left in a cavity—they act like a foreign body, or irritant. A

special condition like infection, preceding operation, changes the technic somewhat.

III. *Pattern of suture:*

Guy.—Temporarily put in with a long loop for traction in place of using vulsella.

Lembert.—In and out at one side of the intestine, skipping the wound, and in and out, through skin on the other side.

Through-and-through.—Stout silk or silkworm-gut on long, heavy curved needle through the skin and deeper layers at once (but not the peritoneum).

Tier.—Each layer by itself:

(*a*) Peritoneum—fine catgut on small needle, full curve, round body.
(*b*) Deep muscle—chromic gut, interrupted.
(*c*) Deep fascia—catgut.
(*d*) Skin—catgut, silk, gut, clips, or adhesive only.

Buried.—Never to be visible again; in deeper layers and not involving the skin; capable of absorption.

Running.—One thread inserted several times without cutting (basting).

Interrupted.—Knotted and cut at each insertion.

Tension.—A very long suture beginning several inches beyond the wound and passing through the skin and deeper layers.

Continuous.—See Running.

Purse-string.—A silk suture in the intestinal tract, on a straight fine needle all the way around in both directions, and poking in or burying the raw flesh, like gathering the top of a bag, then tying securely—to invaginate a raw area (*e. g.*, the stump of the appendix.

IV. *Materials:*

Silk is the most common intestinal suture. It may be used in the heaviest sizes for deep ties and for tractors. It comes in two colors, black and white, braided and twisted, on spools or small cards. The standard time of boiling is five minutes. It should not be used in infected areas.

Linen is used largely like silk, for intestinal sutures, being a vegetable product and capable of boiling for ten minutes. It comes in two colors and four sizes. During operation it is dropped in a sterile cup of water to keep flexible.

Pagenstecher or celluloid linen comes fine, medium, and heavy. It is the ideal non-absorbable suture material, possessing all the advantages of silk, in being strong, easily tied and securely fastened, of uniform caliber and stiff, while more easily threaded than silk even when wet. Being a vegetable product it has less capillarity, and this to some extent prevents infection from passing along the thread (intestinal sutures even when taken with the greatest care, commonly include part of the mucous membrane). Pagenstecher is stronger than silk, hence the longer boiling, which will not weaken it. Both are taken off cards, wound on gauze, and boiled in the bite of sponge forceps.

Silkworm-gut comes in two colors, white and black, iron-dyed, and in three thicknesses, fine, medium, coarse. It is common fishing gut, prepared from silk when it is in condition to spin, but not yet spun. It is an ideal, smooth, strong, non-absorbable, non-porous suture material, softened by boiling, which renders it less difficult to tie. Used dry, it is too hard and brittle to tie. Iron-dyed silkworm-gut is more antiseptic. Silkworm-gut may be used as a stay suture, carried in very deep, through the skin and perineal muscles; but must be removed. It may be boiled repeatedly and kept in alcohol.

Horsehair possesses the advantages of silkworm-gut and is better, in that its elasticity prevents the cutting of tissues. It is the ideal material for mastoids, but not for a tender area such as the lip. White is used on negroes and black on Caucasians.

Ligatures.—The nurse should keep new stock and test all. For ligating deep vessels use plain catgut, coarse or fine, according to the size and importance of the vessels. The surgeon limbers up the ligature by winding it three

times around his warm hand. They must be cut long enough to hold in the firm grip of any sized hand. For coaptation of parts a more slowly absorbing gut (*i. e.*, chromic) is good—delayed union is strongest. For outside work (skin) non-absorbable ligatures (silk on a wart) are used.

Making Catgut.—A hospital may employ graduate nurses or other technicians to make catgut, and procure at great cost the equipment suitable. However, as the making of catgut is not going to be a part of bedside care in the nurse's future work, and as pupils have none too much time in three years to become sufficiently adept at the latter, it seems absurd to employ their time for that purpose. Furthermore, the placing of blame for failure (infection) would become, it is highly probable, focused on the pupils, and, being something not usually proved or disproved, a source of resentment—never-ending. Again, should a nurse, after being graduated, choose some such occupation as catgut-making (can you imagine it?) she would have to begin at the bottom of the processes of the institution she chooses to work in. More and more closely the schools are trying to follow the curriculum laid down by the State Boards, without adding to or taking therefrom. It is hoped that the remedy for the old breach of faith which led hospitals to exploit pupils will quickly show results in a finer type of nurse who will be the more devoted to duty for the stronger protection she is now receiving.

General Addenda:

1. Be sure to lubricate specula (vaginal, rectal) with K.Y.
2. All thick heavy metal must be thoroughly cooled in a deep basin of sterile water.
3. Slides, smear glasses, etc., for specimens are kept in their own basin apart, but sterile.
4. It is an art to wind an applicator
   (*a*) Fluffy at the end,
   (*b*) Easily stripped after with a cotton pledget,
   (*c*) End of metal buried, so as not to inflict a wound.

5. A weighted speculum can be improvised by hanging a quart pail of water to the Sims.

6. Practise taking special instruments entirely to pieces and putting them together again *without any parts left over*, especially the screws in the handle of a tonsil snare, releasing the rod in which the wires are caught, also the tonsillotome; otherwise they will never be cleaned.

7. A left-handed nurse must reverse her gestures for a right-handed surgeon. A right-handed nurse must do so for a left-handed surgeon.

8. The suture nurse should instantly know who owns an instrument, according to the surgeon's or the hospital's inventory, by

(*a*) Its maker,
(*b*) Its style,
(*c*) Its age and condition,.
(*d*) Markings,
(*e*) Numbers.

9. The numbers and other markings on clamps aid in pairing the parts after cleaning.

10. *Use instruments to work with at the sterile table.*

11. When the surgeon says, "There is one sponge back of these sutures," do not let him forget it.

12. See that the patient is sent down in good, clean shape, being washed, dried, rubbed with alcohol and powdered before application of binder, looking for bruises or burns from iodin, which easily happens if some runs down beneath the buttocks where the pressure is great. Report to surgeon if found, chart, and show to ward nurse.

13. Speed is the essence of the operation. Anticipate the surgeon's wants.

14. Large abdominal retractors must be moderately warmed to 100° F. to prevent shock.

15. Hand solutions too hot annoy the surgeon, impede his progress, and make solutions irritating.

16. Irrigating solutions should pass at the lower end through an infusion thermometer (encased in a patent

glass connecting tube) to show the temperature on administering.

17. For a neat skin dressing chloroform seals rubber tissue in place.

18. Saline has certain advantages when used to dissolve drugs for local anesthesia (cocain, novocain, etc.):

(*a*) It is stimulating,

(*b*) It increases blood-pressure,

(*c*) It aids absorption.

19. Finger-cots should be generously supplied at the times indicated.

20. In bone surgery (Fig. 11) the circulating nurse washes and boils each instrument every time it is used—this causes the operation to be slower than others.

Fig. 11.—Lane's bone plates, steel, for femur, for use in fractures of bone.

21. Electric apparatus must not be boiled, especially all the "scopes" and bone transplantation instruments (selected) (Fig. 12).

22. While waiting for the patient to be adjusted, those scrubbed up may cover gloves with sterile towel.

23. Solutions in hand basins are covered with sterile towel till required.

24. All instruments used for amputating and resecting are discarded (and boiled again, p. r. n.).

25. Data should and can be compiled regarding the use and wear on gloves, suture material, ether, etc., for the hospital office.

26. Extravagance in cutting sutures and ligatures makes

the surgeon tremble. It is a bad omen for the nurse's future, if he thinks of her assisting him when he would be the provider. Some firms make short lengths of catgut to save waste, every inch representing the life of animals, the labor of experts, testing and marketing at great cost. Unfortunately the hospital has an atmosphere of indirect responsibility concerning costs, nurses never seeing the persons who foot the bills, Mr. Doe and Mr. Taxpayer.

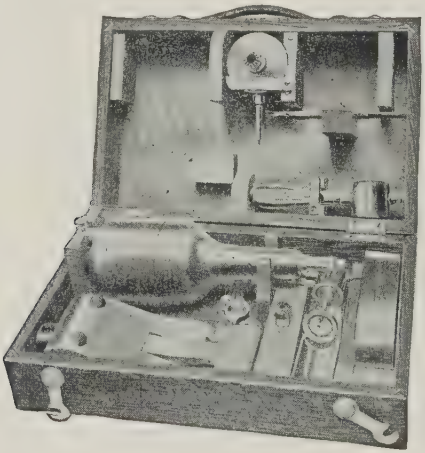


Fig. 12.—The Albee electro-operative bone set.

27. The Lovell needle is built like a ligature carrier, specially devised to sew around the hemorrhagic area after a tonsil operation.

28. Small needles must be threaded quickly. Cut catgut bias, and *know* the needles, whether the eye is at the side or back. If the nurse participates by receiving materials from the area of operation, she should give the catgut a twist or two at the eye, after threading, and it will lie flat. Place the needle, one-third from the eye, in the holder, and hand it with one bend of the wrist, laying the handle in his palm, the mouth pointing back to the nurse, who catches the thread in her fingers taut. The

nurse should know a right-handed surgeon from a left. In watching some operating-room work the laws of common politeness seems to have been utterly forgotten in such matters, leaving out the idea of service.

29. Needles for syringes should be slip-ons, which are cleaner and more easily worked. They must always have a stylet. Special needles for spinal work have an eye, and the point of the stylet is beveled with the needle.

30. Knives are right and left for throat work. If the edge has a full curve it "bellies." Blades set in a frame (tonsillotomes) come under the classification of knives in general care. Paracentesis knives for myringotomy have a double blade and must pass through the small opening of the smallest ear speculum. The handle of a scalpel may be used for blunt dissection. The blade is used inside the abdomen to sever the appendix (then discarded). The bistoury (straight or curved) is used to open abscesses. The amputation knife (different sizes) is used on the extremities. The phalangeal knife (shorter than the last) is used on the hand. A double-bladed Catling knife is used to prepare the soft parts for amputation.

31. Scissors are chosen with an eye for the anatomy of the part and the operator's hand. They are:

Blunt—sharp pointed,
Straight—curved (upward),
Curved on the flat, right or left,
Long—medium—short,
Screwed together—slip apart (mortised).

32. Forceps are selected with a view to the depth of the part to be treated. They are of many types:

Straight or with handles,
Plain or mouse-toothed,
Pivot, screw lock, or mortise-lock,
Smooth or corrugated,
Corrugated crosswise or lengthwise (for reasons),
Straight, angular, or with special curves,
Of varying lengths.

There are forceps for special organs: gall-stones, obstetric, placenta, gastro-enterostomy.

An artery clamp has such an important place (to clamp an artery) that it should never break or come apart, therefore the inferior molded forceps should give way before the expensive but superior drop-forged instrument.

33. Rubber tubing must be boiled and drawn over big clamps to prevent maceration of delicate tissues (intestinal).

34. Idiosyncrasies are permissible in surgeons of skill, and should be noted and served; for example

(*a*) Tall table for tall man,
(*b*) Weight and size of gloves,
(*c*) Method of sterilizing gloves,
(*d*) Left handed—lost a finger,
(*e*) Stools for fat men,
(*f*) Manner of dressing, shoes, etc.

35. An old table may be heightened by putting the feet in four pieces of iron gas pipe.

36. Breast amputations and hysterectomies require many clamps.

37. Keep a generous stock of sand-bags of assorted sizes.

38. Many Politzer bags and plenty of rubber-dam are required for drainage cases by suction.

39. When aristol is shaken on a wound, it may be wound with a bichlorid towel done by the circulating nurse (her arm in towel) (Fig. 2).

40. When a Murphy button is used, for intestinal anastomosis, a very special warning is issued to the ward nurses and orderlies, and the button (Fig. 13) should be the subject of general comment till found.

41. Pus must be closely confined to the smallest amount of linen, and the circulating nurse should handle it with forceps till it has soaked in a disinfectant. Constant pains must be taken to block off avenues of outgoing infection.

42. Loose silk may be drawn into gauze before boiling.

43. A man run over by an auto is, speaking not too literally, a "clean" case. His wound may be infected,

but he would not be a menace to the operating-room. Yet the tetanus germ may find entrance into his blood-stream, therefore the suture nurse should listen for the surgeon's first hint for an injection of antitetanus vaccine.

44. Scissors are tested just before boiling up, on cotton. If the tip only makes a clean cut, well and good. Then try the whole blades. Look for gaping between the points.

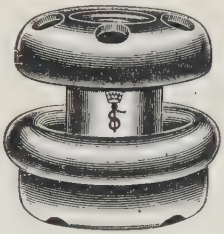


Fig. 13.—Murphy anastomosis button, round, with center collar.

45. Artery clamps which do not work well likely are going to be thrown on the floor.

46. Give the surgeon *a sharp scalpel to begin with.*

47. Mortise locks must never be strained or forced (causes looseness). A mortise is a cleft over a bar, on the bias (bevel). All joints should be well wiped and oiled with sterile oil.

CHAPTER V

THE OPERATING-ROOM SUPERVISOR

"Her price is far above rubies."—*Book of Proverbs.*

Her Status.—A. *National.*—A very close relation necessarily exists between the College of Surgeons, with its clearly defined scope and aims, and the sisterhood, vast but ill-organized, if at all, of operating-room supervisors. A solid footing on which they could arrange the body and method of their instructions could easily be given the nurses by the college. Surgeons have accumulated a large mass of heterogeneous knowledge about the care of edged instruments, the strength of drugs in anesthesia, the pathology of the operating room, *et al.*, which could in a convention be condensed and grouped to teach to beginners. A surgeon cannot really feel sure of the results of his work, when the supervisor gives her own interpretation of his wishes to a pupil who may again give hers in the execution.

B. *Local.*—It would be well for the Board of Directors to visualize what they need and to standardize all the features of the position of opreating-room supervisor, to prevent haphazard selection and hazardous results:

1. Age—possibly thirty, not under twenty-five.
2. Education:

   The highest to be found among nurses, plus training in a recognized operating room plus special work in a still more famous one—possession of one modern foreign language.
3. Advancement:

   Membership in suitable nurse societies,

   Reading of a thesis in such societies,

Approved membership in some social, non-professional club,
Subscription to journals, secular and professional,
Visiting other operating rooms—study of exhibits,
Attending surgeon's lectures elsewhere.

4. Demonstrations of methods to surgeons' committees before engagement.

5. Presentation by the operating-room supervisor's own alumnæ association of a special degree after a period of approved service (including character).

There has not yet been sufficient incentive for nurses to go onward. The careful selection of women on the above five points would leave a comparatively small class eligible for appointment. In competition with other fields for women, hospitals demand a too closely confined conventual life with too small pay for the amount of brains and honorable sentiment required. The greater the strain, the fewer should be the hours. The greater the obligations, the more privileges:

Frequent short vacations,
Pleasant suite of rooms,
Permission to have relatives as guests, etc.

C. The community is directly affected by the attributes of the operating-room supervisor, since the skill she displays will or will not be reflected outside by her pupils as follows:

In offices of physicians,
In operations in private houses,
In making and sterilizing supplies for obstetric cases,
In the care of goods.

When a small community boasts only one hospital, it is sometimes necessary to equip and send out a mobile unit for:

Railway, automobile, or steamship accidents and other disasters,
Contagious cases which cannot be admitted to the hospital.

In these cases the results should be just as good as when the work is done inside the operating room. Furthermore, many cases operated on have a legal phase, that seriously concerns inheritance, domestic relations, or individual rights, hence the records kept in the register must be accurate and complete.

D. Transportation by rail, auto, and airship have made it possible to convey many patients to large, well-equipped, famous operating rooms which owe not a small part of their subsistence to these outside sources. The operating-room supervisor is one of the factors in the decision of the patient to go or stay. If her staff is kind, industrious, and honest, due to her never-ending *supervision*, the patient stays. Moreover, local surgeons wish to feel that their nurses are equal to anything they may bring in. In addition, pupils trained in a small operating room which truly affords better opportunities for supervision, may have to attend some affiliated school for other subjects, *e. g.*, pediatrics, or orthopedics, in which they are called upon to exhibit the essentials of operating-room knowledge. More deadly and invidious in comparison than any of these is that of the neighboring small town hospital eating off the edges of the body of the work of others.

E. In the institution to which she belongs the operating-room supervisor is entitled to a place in many of its councils. Her work is practice rather than theory, and it is given a cash value. 1. The fees charged for the use of the operating room are fairly large, and there should be a monthly balance struck, showing supplies purchased, repairs made, maintenance, service by graduates and pupils, and fees received. 2. Dressings, saline, Dakin solution or other needs for emergency may be sold (by permission of the directress) if the operating-room supervisor feels that she will not be embarrassed thereby before replenishing her stock, at a cost based on the features above named. Nothing but emergency well explained justifies the sale of goods, least of all, operations in private homes to avoid paying hospital fees. Physicians can

arrange to have supplies made at home. It is a pleasant occupation for a retired nurse. Pupils in training have all too little time for learning to be making supplies for outside cases. 3. Again, inside the hospital, the operating-room supervisor has a special footing in the laundry, on account of the quick turnover necessary in goods, and the value of direct speech, rather than via the training-school office. 4. Furthermore, there is a check on careless preparations in the ward, by a system of reporting, when a case comes up badly shaved, or with enema incomplete, to the directress.

Methods of Business.—At present the National Association of Nurses maintains a bureau at 370 Seventh Ave., New York City, in which nurses holding such credentials as described above, should file them, stating what work they wish. This bureau acts as a clearing-house between them and institutions desiring supervisors. It is a serious step to apply for and accept an operating room. The nurse should investigate as follows:

1. The status of the hospital in the reports of the
   State inspector,
   Training-school inspector,
   College of Surgeons' inspector.
2. Its annual report, bed capacity, operations.
3. Number of pupils on operating service.
4. Personnel of nursing staff.
5. Occupational diseases of the town.
6. Local regulations of the hospital,
   Whether open to all in the community or closed to all but a selected few.
7. Personal details:
   Regarding salary, hours of duty, relief for vacations with pay, rooms, duties outside operating room, unnamed obligations.
8. Terms of contract, notice due both contracting parties to terminate an engagement, provision for illness, etc., provision for graduated increase of salary for cause.

One thing to be shunned is "one-man" appointments, or

"one-official" pulls. It is not a healthy state of affairs in which a supervisor is engaged on the recommendation of one surgeon or one superintendent. She should apply openly, in competitive examination, with others, and should at all times present the endorsement of her own Alumnæ Association. To be indebted to one person for an appointment causes partiality to him and unfairness to the rest. No nurse should be engaged without hunting up her references leisurely. No individual member of the Board of Directors needs to have any deep interest in her appointment, for a little creeping up of her salary now and again would provoke jealousy. Open candidacy, discussion by committees and investigation are the only safety. The nurse can easily find in any medical directory the history and achievements of any surgeon. To offset this, she should be able to show what is thought of her by

1. Her own equals, the alumnæ.
2. Her state (registration).
3. Her former employers (hospital).
4. Her professional critics (former surgeons).

It is the unvarying rule of some hospitals never to take on an official temporarily "out of a job," which, though it has its exceptions, in the main works out rather well. Boards of Directors, when looking to commercial registries to provide staff nurses, take a big risk which is unnecessary, in view of the reliability of the professional clearing-house at 370 Seventh Ave., New York, and the safety of communication through the Modern Hospital and other journals of accredited management.

Errors in Appointments.—A. Inbreeding ruins stamina and initiative. Small hospitals would be wise to look for supervisors from larger schools, and to advise their own graduates to take subordinate positions in large hospitals before launching out as heads. Inbreeding is disastrous to stock, speaking in an agricultural sense. If a small group of surgeons know 90 per cent. of all that is to be known in surgery, they can teach only 80 per cent. Their pupils absorb only 70 per cent. Were these promoted as

supervisors, they could teach only 60 per cent. The second generation of pupils would absorb only 50 per cent. Thus in only one cycle exactly 50 per cent. of surgical knowledge would be lost beyond recall to that hospital. Furthermore, familiarity breeds contempt. A stranger does better in a position of rank. "A prophet is not without honor, save in his own country and among his own people."

B. When the stranger is appointed, she should fall into her allotted groove, work and observe, teach the methods that were there before her, and make no changes on her own initiative. When she has been informed by the Surgeon's Committee that she has, in their estimation, passed a successful probation, she may then offer to them suggestions not to be acted on without their consent. It is not a sufficient reason that "we do it this way in our school," to institute changes. She should make the new position "ours," and not refer to the old. In institutional work the life of nurses is in such a constant state of flux that surgeons usually become callous, skeptical, or indifferent to anything but the drudgery of essentials. They succeed long before and long after each appointment. Each new nurse should show deference to their magnitude and obtrude her personality as little as possible.

C. All questions of prerogative and priority among surgeons must be referred to the Surgeon's Committee. Lack of punctuality on beginning, overrunning time prescribed, posting cases on another man's day, etc., are problems that do not lie within the supervisor's jurisdiction. They may interfere with the smooth running of her work. She may inform anyone in authority (the Committee of Surgeons or the directress of nurses) of the obstacles to her work, but she cannot decide an issue.

Personality of the Supervisor.—There are things which cannot be written down in an application, but show in the wear, which yet may be more fruitful of good than academic qualifications:

1. A good sound physique and a rather practical, calm mind. (*Mens sana in corpore sano.*)

2. Determination, ability to plan and carry out a system, presence of mind.

3. Dignity and aloofness.

4. Searching knowledge of human nature, generosity, tolerance of faults, good principles always lived up to.

5. Powers of discipline, impartiality, devotion to duty.

6. Sympathy with the sick, especially emergencies, and particularly willing service then.

7. Breadth of experience and wide observation both of things professional and extramural.

She should be not the showy assistant of a surgeon before the gallery, but first, last, and always the nurse of the patient, and the teacher of the pupils.

A Thing Greatly to Be Desired.—The curriculum of the Board of Regents specifies no details of just what shall make up operating-room training. Text-books hitherto have not dealt with that field. It would be perhaps not impractical to have examinations held every three to five years under the auspices of the College of Surgeons based on the knowledge necessary for nurses to execute their aims in unifying operating-room methods, and expediting work and safe-guarding everybody concerned. This would actually mean the granting and regular renewal of licenses by the College for supervisors. This examination might run as follows:

1. Presentation of records of character, skill, and executive ability.

2. Written papers on newer materia medica, methods of disinfection, anatomy, etc.

3. Preparation of pupils to be suture, anesthetic, and circulating nurses for various types of cases.

4. Demonstrations of aseptic technic, making dressings, making solutions.

5. Physical and mental tests.

If the examiners are surgeons and nurses in the van of their professions, this will tone up the whole service.

Teaching.—A. No one need ever say that the reasoning powers are not brought into play in nursing. Girls are notoriously weak in arithmetic, knowing which, the operating-room supervisor must teach the principles of arithmetic soundly to her pupils all the time, and *never take anything for granted.* This should be a fixed custom. For every solution to be estimated, the pupil should work out the problem on paper and present it for the supervisor's O. K. before handling the drug. A few types are given below.

Stock—Bichlorid of mercury tablets marked grs. viiss. Solution of 6 quarts.

Strength 1 : 6000 required.

1 tablet to 1 pint (sterile) water = 1 : 1000 solution.

1 tablet to 6 pints (sterile) water = 1 : 6000 solution.

= $\frac{1}{6}$ of the strength or six times as weak.

Stock—Lysol, pure (100 per cent.). Solution of 4 quarts of 1 per cent. solution required.

℥j to 1 pint (sterile) water = 1 per cent. solution.

℥j or ℥viij to 8 pints (4 quarts) (sterile) water = solution required.

Stock—Silver nitrate tablets grs. v. Solution of 1 pint of 1 per cent. solution required.

℥j of any pure drug = 480 grs. (round numbers 500, approximately).

grs. v of drug = 5/500 (5/480) or 1/100 or 1 per cent. of an ounce.

grs. v of drug in ℥j (sterile) water = 1 per cent. solution.

16 ounces = 1 pint.

16 times grs. v of drug (or 80 grs.) in 1 pint of sterile water = 1 per cent. solution.

Stock—Morphin sulphate, gr. $\frac{1}{4}$. Hypo. ordered, gr. $\frac{1}{6}$.

Dosage by hypo. in arm requires amount from 8 to 20 minims. Choose a common multiple of 4 and 6—not the *least* common multiple *always*, but one suitable for size of dose by hypo. in arm.

Factors of 4 are 2 and 2.

Factors of 6 are 2 and 3.

Multiple must contain two twice and three once = 12.

Dissolve gr. $\frac{1}{4}$ in 12 minims sterile water, with usual aseptic technic.

If, then, gr. $\frac{1}{4}$ is contained in those . . . . . 12♏

then, pro rata, gr. 1 is contained in 4 times 12♏ = 48♏

and hence, pro rata, gr. $\frac{1}{6}$ is contained in $\frac{1}{6}$ of 48♏ = 8♏

12♏ − 8♏ = 4 minims.

Draw up the whole 12 minims to syringe where it can be measured. Expel air and 4 minims. Give 8 minims.

House rules on solutions should be framed and kept clear.

In teaching arithmetic, the supervisor should keep a collection of all data requiring such adjustment in a book for that purpose, and hammer at it incessantly till each new pupil is familiar with this rule of three as applied to drugs.

B. *Anatomy teaching* is also essential. This is taught by charts, drawings, and dissection, in that order. The chart prepares the pupil for what to expect. A drawing corrects errors in her mind. If she draws the part, her knowledge is built up and supplemented. The dissection of a small liver, a chicken's heart, or lungs, a beef tongue, etc., will give the lesson more point than anything else. The teacher explains the abnormality or accident, the pupil suggests (with help) the remedy, and the teacher points out what instruments and dressings are best suited for the operation. Moving pictures of similar operations are very helpful, because they can be arrested so that the

pupil sees the surgeon's hand better than in life, and the array of materials he is using.

With our present lax methods in all forms of education, the lack of discipline makes it difficult for hospitals to set a higher standard of living than is found outside, but if a pupil shows ignorance of anatomy and materia medica she should be sent back to the lower grades. Nurses are so keen to have operating room that this may be used by the teacher of junior anatomy as a powerful incentive to study. Cards of samples, instrument catalogs, and the instruments themselves should be laid out so that the pupils may reason out which are most suited to the parts. Classes should be held in precise form as in college, with perfect preparation by the teacher and perfect attention from the pupils. Notes are taken and inspected, forming the nucleus of a text-book when the pupil may be a head nurse. Data are memorized and every possible contingency anticipated, otherwise some unexpected change or request will seem about as pleasant as the stalling of a motor in an aëroplane.

C. *Demonstrations.*— In a brief form the supervisor must list, demonstrate to, and see demonstrated by the pupils every act they shall perform during this service. The equipment is always there. There are many moments or lulls. Each nurse's card bears the same list. She O. K.'s each point when she executes it and again as the pupil does it.

1. Dusting,
2. Binders,
3. Opening sterile packages,
4. Scrubbing up,
5. Setting up,
6. Opening a sterile towel,
7. Making saline,
8. Draping patients,
9. Conducting cases,
10. Running sterilizers,
11. Folding linen,
12. Passing sponges and ligatures.

D. *Nursing Care.*—The nursing spirit usually burns low in the operating room. It needs fanning. This can be done by:

1. Sending pupils to relieve on the wards on Sundays.
2. Conferring frequently with ward head nurses about the departure and arrival of operating-room nurses with patients—the ward nurse should inspect binder and gown before releasing them.
3. Watching and teaching to prevent
   Burns, with confined iodin,
   Bruises, leaning on ether case,
   Poisoning by overdose of bichlorid,
   Paralysis by too long Trendelenburg.
4. Sending pupils to study the progress of the cases they had, as to drainage, primary union, removal of packing as specified.
5. Specially caring for administration of hypos.—charting where given and *by whom*, to focus blame (if abscess).
6. Observing the conventions just the same as if the patient were conscious:
   (*a*) Orderly absent when women are operated on,
   (*b*) Also in genito-urinary cases if nurses are present,
   (*c*) Guard on all conversation,
   (*d*) Colored physicians absent in gynecologic clinics of white patients,
   (*e*) Patients properly draped, and sheets not carelessly whisked off.
7. Inspection of all cases before going to their beds.

E. *Economy:*

(1) Unnecessary expense comes from destruction of goods:
   (*a*) Oil ruins rubber bags,
   (*b*) Lemon juice eats enamel and porcelain,
   (*c*) Chloroform dissolves and eats fine tissue.

(2) Ends and pieces may be used to advantage in another form:
   (*a*) Bandages make packing in odd minutes,
   (*b*) Edges of gauze folds make stuffing for pads,

(*c*) Catgut is saved by carefully estimating what is needed,

(*d*) By special planning, gauze can be cut so that all is used, the original fold at the side being left intact.

(3) Prevention of stains by quick washing lengthens the life of cloth. The laundry people will buy sulphuric acid at their own expense to bleach, rather than go without it, in the hospital effort to save cloth fiber. Blood is removed by cold water soak, or paste of laundry starch.

(4) Good goods, carefully bought, will last better than cheap, and give better results, besides costing less in the end, if handled right.

F. *Wisdom in buying:*

(1) Comparison of textures. Samples of gauze from different firms show number of threads to the inch, fineness of threads, number of yards to the pound, evenness of run, etc.

(2) Receiving goods and inspection of same before paying for them.

(3) Comparison with other hospitals.

(4) Study of advertisements.

(5) Information from military and naval hospitals.

The buyer for the hospital will probably bring pressure to bear on the operating room to take a cheaper grade of gauze, cotton, rubber, ether, etc. It is probably within the surgeon's sphere entirely to decide whether gauze is sufficiently absorbent, but the pupils may find it takes too long to make it up—it is sleazy, uneven, and thin. Cotton may be friable, rough, lumpy, dirty, or containing burrs. Rubber may be very malodorous and brittle (made out of ancient automobile tires). Instruments may be ill-fitting and badly plated, delaying a case or the clean-up. The pupils should keep tab on all goods, and all opinions expressed by men while operating, who shed as they go down to the street the annoyances that they thought so

big in the stress of work. How the patient fares under long used good ether is a sufficient reason for not changing.

G. *Repairs.*—Missing instruments should be traced or paid for, and it is possible to trace the loser if the head nurse is watchful. (See under Suture Nurse.)

H. *Discipline.*—Decorum is maintained in the whole suite. Proper dress, plain coiffure, absence of rouge and jewelry of every sort (especially rings), strict personal hygiene are essential. Forwardness, quarreling, noisiness, etc., should lead to degradation in rank on the first offence. Chaff and banter when a patient is waiting for the anesthetist are unsympathetic. There are perfectly fair penalties to impose:

(*a*) Partial loss of time off for laziness,
(*b*) Repeating work till well done at sacrifice of required time,
(*c*) Regular report to superintendent of nurses,
(*d*) Return to ward service if dull, or undesirable,
(*e*) Recitations, loss of cap, sending to isolation, etc., according to degree,
(*f*) Sending to coventry (no intercourse with other pupils).

It is poor policy to keep a poor pupil, for each year it is harder to dismiss her.

I. *Prevention of Infections.*—The worst disgrace that can be endured in a hospital is an infection in an operated case—hernia, eye, perineorrhaphy, bone case, etc. The supervisor is working with six hands which she cannot wash, *i. e.*, the pupil's hands. She requires enormous will power to project into their minds, to charge them with her own force, to keep clean. She requires, besides, a sixth sense, the uncanny power of knowing what folks are at when she isn't there, which makes some youngsters call their teacher "four-eyes." By being absolutely honest toward her work herself in all its aspects, and by wishing frightfully hard that they may be also, she may get the desired effects. But prevention of dishonesty is imperative, also unjust suspicion is very dangerous. Hence

the supervisor must be a live wire, constantly on the move, never luxuriating in long, quiet chats with someone. It will make her hair gray faster than the other nurses, but the institution will become famous. Not only should the nurses scrub thoroughly, but they must keep to clean places, and boil or steam goods the required time. If a nurse breaks a rule about the temperature of hot-water bags during probation, she will likely develop no finer moral sense before she comes to the operating room. The supervisor must anticipate, fear and prevent. Care must be exercised with masks, mouth-washes, suits, etc., among the whole staff.

A check should be exercised on the orderlies. Many of them are the flotsam and jetsam of the world. Others are devoted attachés, but it is necessary to know that they are clean and free from disease.

J. *Self-reliance.*—Night work, relief work, substitution in vacation all form a good school for self-reliance. Most pupils do excellently when left temporarily to their own resources. Notebooks of house rules, and movies or charts of typed cases may be used. The leading-strings must be removed early, as with infants. When going off duty daily the supervisor should sketch what will likely happen.

Inspection:

I. Rounds are made for daily cleanliness:
   (*a*) Instruments, etc., of suture nurse,
   (*b*) Anesthesia outfit,
   (*c*) General dusting by circulating nurse,
   (*d*) Cleaning of floors by orderly,
   (*e*) Engineering equipment put in order early—requests in early,
   (*f*) Reports and time-slips to directress of nurses.

II. Weekly or semiweekly rounds are made with the directress of nurses, who observes nurses' industry and demeanor, condition of equipment, attitude of doctors, and condition of patients. If nurses seem worn, examination by physician.

III. Inventory is taken at regular intervals to keep check on valuable goods.
IV. Semi-annual rounds with the superintendent, for painting or plastering.

Preparedness:

I. A generous stock of filled covers of gauze and cotton in circulation on the wards (if there are not ward sterilizers).
II. A generous stock of every kind for the operating room.
III. A big reserve of sterile goods.
IV. A big reserve of goods done up, but not sterilized.
V. A store of gauze, cotton, muslin, flannel, raw plaster, etc.

There are reasons for this reserve:

I. The old-fashioned maddening dearth of everything on Sunday.
II. A big disaster in the city.
III. An epidemic among the nurses eligible for operating room.
IV. A breakdown of sterilizers.

The night supervisor should be free to use all the supplies she needs, on rendering a report of instruments, saline, or dressings taken.

The operating-room supervisor should visit the wards to see if gauze is wasted, and keep an estimate of how much is needed by a big drainage case.

State Laws.—A. In New York State, under the Harrison law, an accurate account of all narcotics must be kept. This is getting the cart before the horse, because it puts a duty on decent people, but as nurses gladly assist their government in its moral aims, the records are kept well. However, it is hoped that something may be done to prevent cocain from being smuggled and handled freely by the wrong people. A report must also be made of stimulants, denatured alcohol, and radium. The operating-room nurse, being more mature and informed, can see why, in this generation, it is dangerous to leave such things about carelessly.

B. The staff must take part in frequent fire drills. Fire in the vicinity of an etherized patient is too awful to contemplate. The equipment of extinguishers, axes and saws, hose and fire alarms should be used at regular intervals by all the pupils. Assignment of each pupil to a post should be a part of her service in each of the three shifts. Blankets and stretchers belong to the orderly. Closing of windows and doors, protection of hair and lungs, etc., all are included and form no insignificant part of the fire code as it should be observed in every building today, according to state regulations. In case of fire the operating-room register should be saved.

Health of Pupils.—(1) Style of shoe is an important item on the unresilient floors, depending on the orthopedic surgeon's advice to those who have undue trouble. (2) Bichlorid rashes must be avoided, usually by using the brush no higher than the wrists. Nightly dressings of lanolin have been thought best if they do occur. Drying the hands thoroughly with absorbent towels is very necessary. Nurses must rinse soap off thoroughly before immersion. Soap causes with bichlorid a black scale, then a fissure. A dash of hand lotion after operation helps keep fit. Dutch cleanser is a powerful irritant to some skins, also washing soda, alcohol, and ammonia. Fresh air, few if any late leaves, little walking, and early retiring make for better health during the operating service.

Statistics.—The head nurse should make a study of the time consumed by each surgeon for each type of case, so as to help the Committee of Surgeons to adjust problems relating to booking operations. The length of time required by each pupil to set up and clean up should be investigated and shaved down by practice and correction. The number of instruments used by different surgeons, if recorded, makes a ground for using up large spaces of time in after cleaning. Sizes of gloves for different surgeons and interns are entered for reference. Special whims regarding materials and methods will gradually diminish, owing to the concerted effort of the

College of Surgeons toward simplification, barring the actual proved benefit of any one thing, the loss of which cramps an operator, and barring the destruction of originality. The patient's chart contains, for the use of the ward nurse who immediately begins to carry on, a concise report of the operation. Some time within twenty-four hours the assisting intern adds on a sheet specially for that purpose the history of the operation in its entirety.

Academic View of the Supervisor.—Though referred to in other relations elsewhere, it must be noticed here that a supervisor oversees, and as such, must be higher than the workers among instruments. The unconscionably long list of duties, with their corresponding breadth, which are laid upon her, render it impossible to chain her to the leg of a suture table, from which she cannot see and know what is going on in workrooms, supply rooms, or wards. Any ordinary pupil *who has successfully passed first year tests* can be taught to be a good suture nurse,

(1) Because she naturally wants to please the surgeon,
(2) She is keyed up higher than on the wards,
(3) She has rehearsed it successfully to the supervisor before 8 A. M.

To make a humble comparison in domestic affairs, the chatelaine of a mansion on Fifth Avenue is a first-class housekeeper, but she does not assume the duties of a waitress and send the maid engaged for such a purpose to oversee the work of others. The supervisor should be engaged, in the first contract, not as the handmaid of any one "difficult" surgeon, but as head of the operating suite, and capable of putting her knowledge and skill into her workers, so that the praise they earn means tenfold for her. It is a lazy mental habit which causes the head to scrub, giving behind sterile intrenchments vague disconnected orders that far from ensure sound honest work behind the scenes. It is also a jealous mind, usually, that leads the head to scrub and remain in the pleasant atmosphere of the operating room, with the surgeons, to

which the pupils are remarkably sensitive, since their chance for development is destroyed. From the standpoint of the surgeons, while they are serving worthily as attendings, not the least of the many benefits they bring the institution is that of developing talent for the future among the nurses. "To scrub or not to scrub, that is the question," which should have a recognized interpretation by having the Training-school Committee, Committee of Surgeons, and directress enunciate a policy that is written into the contract for supervisors. It needs no shrewdness to note that the supervisor who likes to scrub would probably never wet her fingers if placed temporarily on a ward. The surgeons who teach nurses will be rewarded by enthusiastic devotion. All the features of the operating room form the keys and stops of a big pipe organ, on which the supervisor can bring forth no harmonies if she chooses only to work the bellows.

Summary.—It can readily be inferred that the supervisor requires alertness, suavity, self-control, a fine but not dominating sensitiveness, optimism, shrewd powers of appraisal of men's motives, a well-defined plan for her own future, and her windows open to the outside world. Such a woman needs intensive recreation, no night duty, and strong support from others concerned in training understudies and future heads. The winner of deathless fame in the hospital world is she who from the background reproduces in hundreds of pupils her own skill and honesty.

MODEL OF LESSON BY OPERATING-ROOM SUPERVISOR

8.45 A. M.: Nephrectomy—lumbar route.

This is to bring out the points of difference between the case in hand and others.

The supervisor demonstrates to the suture nurse and circulating nurse. The anesthetic nurse is the patient.

7.45 to 8.00 A. M.

Required.—Works of reference on gross anatomy, minute anatomy, surgery, materia medica, cinemato-

graph, charts, mannikin, skeleton, notebooks and pencils, a text-book on operating-room procedures for pupils, chalk, blackboard, patient's chart, *x*-ray, history, pathologic findings, diagnosis, marking of diseased kidney, film of a nephrectomy, this route, instruments, towels and other (unsterile) paraphernalia for this special operation, table easily adjusted for kidney position and wheeled in (patient kept outside on it at first), kidney bag, pillow. *A pair of kidneys on a tray from the diet kitchen.*

Remarks.—May be necessary to resect a rib (not often).

Lumbar route avoids cutting peritoneum.

Only one cut needed—kidney not connected with anything above—to extirpate, while to extirpate the uterus there are three (two tubes and cervix).

Important to patient to *retain one good sewer* (never to take out the last remaining kidney, nor the well one).

Demonstration.—Patient "etherized" outside, put in position, wheeled in.

Stripped, examined, marked kidney corresponds with pathologist's findings, *x*-ray, etc.

Draped with towels, lap sheet, etc.

Instruments arranged as per movie, participants close in.

Supervisor shows incision, varying in length with stature of subject, quantity of fat around kidney—compare with chart to show relation of skin, muscle, kidney, and peritoneum.

Shows delivery, clamp, ligation, walling off, amputation (by drawing or on pair of real kidneys).

Counting sponges, needles, etc., before closing.

Dressings, adhesive, binder, clean up, stretcher.

Emphasize seriousness of hemorrhage if renal artery is cut, and fatal result if it is on good kidney.

CHAPTER VI

THE MAIN OPERATING ROOM

Planning.—When a new hospital is built or a surgical wing added, lucky is the city which has a donor of sufficiently open mind to present the operating-room suite and introduce into it all the desirable features known to date. An instance of this occurred very recently in Portland, Oregon, which, thanks to a private philanthropist and a surgeon advising him, possesses, in the Clark Memorial Surgery of the Good Samaritan Hospital, all the equipment necessary to facilitate the work carried on there. It is impossible to graft an ideal system of heating and ventilating on an old plant. A hospital is a growth, usually beginning with a few beds, in an old private house, or with an afternoon clinic in a slum. Only in the western cities, which themselves are young, does a fully equipped many-sided hospital spring suddenly into perfect existence overnight as Eve did from Adam's side. The construction of the operating-room suite is most costly and difficult, requiring innumerable sketches, suggestions and estimates, with visits to other institutions and careful listing of features required by those who will work there (Fig. 14). A council on building should contain representatives of all the elements interested:

(1) Board of Governors.
(2) Medical Board,
(3) Architect,
(4) Superintendent of nurses and operating-room supervisor.

It is not to be forgotten that the last have just claims to be consulted. It has been proved that women have a *flair* for planning. Just as home planning has recently been perfected by the feminine influence, so has hospital planning. Lack of space to work in, and the absurd ratio

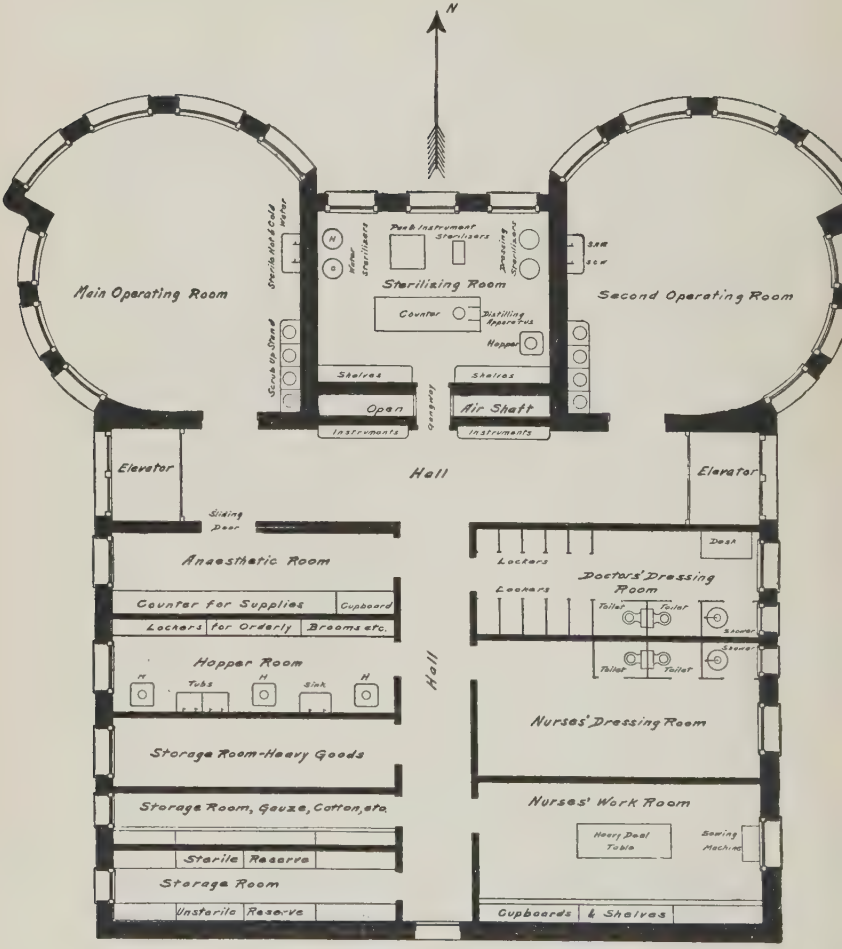


Fig. 14.—Model operating-room suite.

between number of beds and equipment were faults in the old buildings which impeded nurses' work. Let the Board settle the limit of the cost, and devise means to

obtain the money. The surgeons may speak of the portion affecting them directly, air-space, ventilation, tables, etc. The nurses should certainly have and express ideas relating to work-tables, closets for supplies, dressing-rooms, and business office. A safe proportion of their separate influences on the result can be struck by estimating the number of hours each will spend there. Nurses usually visit for comparison more than officials or even surgeons do. All drawings of the structure should be framed for easy reference in repairs.

Position.—The suite should be very accessible, and yet cut off from the rest of the institution. This sounds paradoxic. In a skyscraper it should be at the top, with special elevator signals (particularly for fire-drills); on the cottage plan, it may be in a separate pavilion, centrally located. The heavy smell of ether should not reach the ward visitors. The noise of visitors, laundry or garbage collections should not reach the surgeons. In a pure atmosphere, one may demand clear thought, precise calculation, and quick, clean action.

Size.—An operating room can be too large, wasting heat and energy in maintenance and cleaning. It can be too small, crowding the surgeon and menacing asepsis. The purpose of the room should be studied, the type of table, the paths to be trodden for supplies, all sketched out, then not one foot more or less constructed. It should be tested for its acoustic properties, to permit an operator to lecture in his clinics.

Heating.—The most modern form of heating is combined with ventilation. Shafts in the walls lead to the engineering plant below, which forces drafts of air (washed and heated or cooled according to the season) into the room. These fan-driven currents find escape through vents in or near the floor, which discharge to the atmosphere, so that workers do not rebreathe their own carbon dioxid. This air must be obtained from a clean place and kept separate from the humid atmosphere of the sterilizing room. Steamed air depletes the vitality

of the nurses, ruins the instruments even in closed cases, and affects the texture of the walls. If hot-water heating is retained, it may be in one of two forms—(*a*) Coils flatly laid against the wall at a considerable height, not more than 10 feet, to permit easy cleaning; (*b*) coils on the floor, spaced at long enough distances to show and permit removal of dust, and covered after dusting with square boxed whitewashed covers to cut off the ascent of dust; (*c*) coils in alcoves in the wall with open grill in front. Heating from 75° to 80° F. is favored, since the patient is lightly dressed, his vitality lowered and his pores open. Special heed is taken to prepare him for transportation afterward. A recovery room, on the same floor, near by, reduces chance of pneumonia. Trendelenburg requires extra wraps. Window deflectors send the heat upward from coils which must be set below the windows. Steam heating is not to be considered, because it is not uniform and leaves one unprepared for emergency work.

Uniformity of heating means that the room shall be 75° to 80° F. day or night, winter or summer, hot or cold days, with which fixed condition the dress of patients may always be the same. Nurses will require warmer clothing for the street when on this service than on others. Openings at the floor permit "gravity exhaust" of used air to shafts below.

Finish.—Tiling is expensive in proportion to the perishability of all changing hospital construction. Plaster and paint are most common. The surface should not be highly glazed, on the contrary, a dull lusterless finish. Paint should be of a neutral color to clash as little as possible with the white of gowns or towels and the redness of a gaping wound, as the surgeon sometimes raises his eyes when palpating the deep tissues. French gray, dull greens, buff are among colors selected.

Light.—There are two kinds of light: (A) Natural and (B) artificial. They cannot be employed simultaneously.

(A) Natural light is not to be taken from any side but the north, as the absence of direct rays causes more equal

diffusion. In an artist's studio this is observable. A skylight is cold and uncleanly, as well as a menace from the elements. A glass projection, however, 2 feet deep and 6 to 8 feet long and reaching to the ceiling, serves to catch light from three sides, throwing it into all corners, yet casting no shadows. This requires storm sashes in winter. Windows may be, at least the lower half, of frosted or ground glass, for privacy, especially in large cities with other tall buildings. These windows had better be screened, in case the forced washed drafts from the engineering department fail, but if it is going well, the control of heat and ventilation is within and there is no need to open windows and expose the wound to city dust. Every window and door of a hospital should be screened and well guarded. If in the old style institutions windows must be opened for air, the curved box of finest wire netting, following the up and downward swing of one leaded glass pane, prevents a draft on the patient. A pane opening like a door is dangerous.

(B) Artificial light should regularly be of only one kind in the presence of ether—*i. e.*, electric—though provision is made with storage batteries for sudden interruption of current in accidents. It may be direct or indirect. Direct lighting is so arranged that bulbs hang directly over the table. These bulbs should be of frosted glass, to prevent shadows, and high enough not to burn the tallest surgeon's head. A glass plate should be slung underneath the bulbs to prevent dropping of dust, clear under frosted bulbs, and ground under clear. Nitrogen gas in a frosted bulb gives a powerful light with economy in current. For an ordinary operating room, six 100-watt tungstens make an excellent night light. In some old buildings a reflector is used, placed high for wide diffusion, even by day, when the sun is withdrawn. In buildings of the expensive type, an arched or angled attic is built over the operating room, with a ground glass floor studded with bulbs. None but the electrician has access to it, the small bulbs forming through the glass a glowing sheet in the ceiling of the

operating room equaling a sunlit sky. Few can afford the wonderful Zeiss light which is generated outside and projected upon a number of mirrors, whence it falls in six or more intensively illuminating pencils upon the wound. These pencils do not cast a shadow if a person intercepts them. There should be no high lights or deep shadows or reflections on the inner surface of spectacles. Before purchasing, various companies should demonstrate on the ground that they can eliminate heat, shadows, and glare.

For eye work, frosted or ground glass bulbs must be provided. Gazing into the retina, near the bulb, the wires or filaments must not be visible to form an antagonistic picture in the oculist's mind. Every sort of droplight customary in eye hospitals should be here:

1. To be wound with sterile gauze for the operator.
2. To be held by a nurse.
3. To be perfectly flexible so as to move 1/16 inch if required.

The engineer is a very important member of the operating-room staff. The nurses really must be taught by demonstration the meaning or uses of the following:

1. Current, direct or alternating.
2. Transformer.
3. Rheostat.
4. Switch.
5. Watt.
6. Cystoscope, auriscope, laryngoscope, etc.
7. Battery.
8. Dry cells.
9. Storage.
10. Fuse.
11. Motor.
12. Dynamo.
13. Cautery.
14. Filament.
15. Nitrogen bulb.
16. Tungsten.
17. Plug.
18. Socket.
19. Vacuum.
20. Meter.

Rules for Keeping Electric Equipment in Order:

1. Do not handle any apparatus without having had a lesson on it.

2. Turn off the current before screwing in or unscrewing bulbs—it blows out the fuse and all the lights on one line.

3. Keep the plan drawn by the architect, framed in a conspicuous place, showing the line of lights controlled by each fuse. (Note: All plans of plumbing and gas should be shown also.)

4. Put chain sockets on all high lights, so that short nurses may reach them.

5. Supply several switches on the walls, to control all lights in small groups, and modulate the amount of lighting.

6. When connecting up an electric instrument, test the current first, then turn it off while screwing the plug in.

7. Numerous base plugs make floor lamps possible.

8. Apparatus must be dusted.

9. Cords must not be coiled tightly or turned sharply back—this breaks the delicate wires and causes a short circuit and burn.

10. Patients under anesthesia are easily burned. Never leave a bulb on the body with the current on.

11. Repairs on the lighting system should not affect major operations.

Corners.—Coved or rounded corners are best for ceiling and floor, permitting easy cleaning (dusting or flushing). The orderly must be taught to mop *away from* walls, and to bend his knees and wipe the walls separately with a clean hand cloth. It is not right to let cleaners have their own way, else the ancient history of the room may be read in the strata on the walls.

Disinfection.—Modern laxity notwithstanding, the room should be disinfected regularly and after any unusual case. Modern methods of cleaning after infection have not yet been proved right. The test is *whether we would wish to have a hernia done* in the hour following a case after which we thought it unnecessary to disinfect. What is due the staff is due all patients.

(*a*) *Live Steam.*—In the Methodist Hospital in Brooklyn, N. Y., a connection is made with the boiler-room, by which when the room is closed, live steam is turned on

for one hour through special pipes adjusted outside the door. This is necessary for every "septic" room.

(*b*) *Fumigation.*—Based on the sort of infection, usually a germ belonging to the vegetable kingdom—hence formaldehyd.

(*a*) Seal all windows but one, closed only, easy to open.

(*b*) Seal all apertures so as to permit not even a smell to reach the rest of the hospital.

(*c*) Adjust fumigator (pump) at keyhole, or

(*d*) Build pyramid of bricks, basins of water, dry basin of candles, alcohol and match, or

(*e*) Protect floor from stain by overflow if potassium permanganate is used—old rubber sheet.

(*f*) $KMnO_4$, ℥iv to formalin Oj to every 1000 cubic feet of air space.

(*g*) Remove everything which can be boiled or steam-sterilized for use in the interim.

(*h*) Consult with Committee of Surgeons, basing disinfection on laboratory findings, so as not to upset schedule on too meager authority.

(*i*) Candles of certain size and potency are made for certain proportions of existence.

The operating room, in its broadest sense, should always be ready for use. A case may elude the most watchful, and show tuberculosis, typhoid, or some of the exanthemata. For the public feeling of security, no chances are ever to be taken. Hence a second room should always be available, possessing all the necessary characteristics, and equipment should be of a mobile nature—nothing nailed down. The late war has enabled many nurses to prepare themselves quickly for a complete "volte-face."

Doors should be plain, smooth, thick and heavy, to block sound, and swing both ways. The best of springs, set in brass boxes, flush with the floor, and handled as all expensive fittings should be, will enable a nurse to pass

with a tray of instruments without losing her balance and possibly slipping on a wet spot with rubber heels and getting a wrench or sprain. Each door should be fitted with a small window of wired glass, about 1 x 2 feet, at the bottom of the upper third, flush with the wood, so as to enable one to distinguish the presence of a person on the other side. This prevents a head-on collision and the possible smashing of valuable instruments. Those scrubbed for operation remain in the amphitheater and must not pass through doors till finished. Doors should be made of wood thoroughly seasoned, so that they neither warp nor bind on account of the humidity. Doors are closed when a case begins.

Perfect Cleanliness.—The eagle eye of the supervisor must detect any slips, "holidays," or forgetfulness in the whole suite, carrying in her mind certain high points that are usually taken casually in a private house:

Overhead lights,	Tanks,
Pipes,	Coils,
Projecting surfaces,	Cords,
Windows,	Stools,
Shades,	Tables,
Standards,	Cabinet tops.

Removing mere lumpy excrescences is not dusting in the true operating-room sense, but it consists of:

1. Soap and water and brush.
2. Sapolio on streaks.
3. Labarraque's solution on bichlorid stains.
4. Sandpaper on roughnesses.
5. Oxalic acid on rust.
6. Whiting on paint,
   Silicon.

The real potency of one's religion is easily discovered in the ardor and thoroughness of operating-room cleaning. True honesty in nurses makes this room the Verdun of the germ. Had each nurse a gaping wound over her eye, she should not fear to have it swabbed with swabs from any corner of the room she cleaned. Next to cleanliness

is order, which prevents confusion. Seeing germs from operating-room cultures grow in the laboratory may be an incentive to honesty.

Plumbing.—A. *Scrub-up stands:*

1. Must be visible and accessible at a wall with a long, open sweep, not in a corner where men jostle.
2. How to turn on the water:
   (*a*) Knee-swell, fine in theory, but too delicate for practice—parts break.
   (*b*) Foot-tread, has worked out best.
   (*c*) Elbow—necessitates 2 faucets—not good.
3. One faucet, containing mixture regulated below, usually preferred.
4. Fixtures must be tested before each clinic, and repairs made in time.
5. Members of other operating-units must not use this stand.
6. Water must not return after one laving—hence no stoppers in bowls.
7. Patented arrangement for liquid green soap to drop on hands by tip of elbow.
8. Scalding by the sudden sticking of a hot-water fixture renders the surgeon *hors de combat*, makes him more susceptible to bichlorid, and benumbs the nerves used in palpating.
9. Repairs in progress elsewhere in the building affecting the water-supply should be reported to the supervisor, and times chosen not interfering with necessary operations —taps should be turned on and a large water-supply reserved—when the engineer turns on the supply, sediment must not be allowed to run over linen or delicate instruments.

B. *Faucets from water-sterilizers:* These are not impaired as to sterility of the water by being carried through the wall. The presence of sterilizers in the main room is inimical to healthy tone.

1. Must be controlled by foot-treads or keys.

2. Should be polished by the orderly, then wiped with disinfectant by nurse when dusting.

3. A portion is let off before using.

4. Supply for hand-basins, irrigating tank, douche cans is obtained here.

5. Regular testing and cleaning of filters is necessary (on the other side).

Tables.—A. *Operating:*

(1) Material—monel metal is preferred, easy to polish, every-wearing, impervious to solutions, non-chipping, showing no stains.

(2) Structure:

(*a*) Pedestal base most popular, with oil-pump and pedal to raise and lower to height required by stature of surgeon.

(*b*) Anesthetist should control, by one hand-wheel, which runs steel worm gears, noiselessly. He needs often to decide and act very quickly.

(*c*) Perineal recess made of nicalloy, a non-erosive, necessary for gynecologic surgery.

(*d*) Etherizer's screen aids asepsis, foot rests and knee crutches for Trendelenburg position, kidney elevator, etc.

(*e*) Goiter table permits head to be lowered.

(*f*) For deep abdominal work, it is advantageous to tilt table to right or left.

(*g*) Ball bearings necessary on all wheels.

(3) *x*-Ray attachments:

(*a*) For fracture work a special table is devised, the operator sitting on a stout saddle (for extension) and watching the approximation of the fragments by fluoroscope.

(*b*) For cancer, fracture, ulcer, etc.—shadow box on the wall, with plates previously made, showing up lesion, by transparencies.

(4) Names of tables most used—Balfour, Hawley, Albee, and Ward. The table too heavy to move

out to the anesthetic room may gain in solidity, take a good Trendelenburg, and be more easily wound up by the one hand of the anesthetist (Balfour). In committee the number of fixtures should be diminished rather than increased. Old-fashioned tables may be raised by sockets of lengths of gas pipe.

B. *Suture Tables.*—Made of monel metal, and only one shelf (asepsis), also semicircular, preventing intrusion from outsiders. The rolling-stock of casters should be in duplicate for repairs. Lock rollers permit immobilizing.

Stools.—These are necessary in graded heights, shapes, and lengths for surgeon (very stout), anesthetists, and circulating nurse if she has a minute to spare. The internal feminine mechanism requires it. Psychologically speaking, the knowledge that one *may* sit helps to eliminate fatigue. The surgeon stands an hour, working off his energy, then rides all day in his roadster. The nurse stands, waiting, and is on her feet all day. Long, low wooden stools at the table help for short persons and provide resiliency.

Clock.—A silent clock simply throwing out a sheet, announcing the hour and minute in big block letters is a good feature; the exact knowledge of the time remains in the mind better when read thus, "2.20," than when calculated from a picture of two hands.

Signals.—Electric signals may be arranged in the floor or at the base, to be operated by the foot, giving a silent call to the other portions of the suite for the circulating nurse. This system is operated by the suture nurse or supervisor, just as a hostess summons a maid.

Blackboard.—Messages for operating surgeons may be written on a blackboard—records of sponge count also—calls for interns to their wards.

Table Pads.—Stretchers and tables should be provided with stout pads of curled horsehair with air compartments, boxed at the edges to remain square and prevent the patient from rolling off the table. Their softness saves

the patient's tissues. They do not affect the position required for the organs. Fatigue and bedsores are eliminated.

Cautery.—The fixtures for the cautery should be in the main room, but out of the way of the operator. If ar-

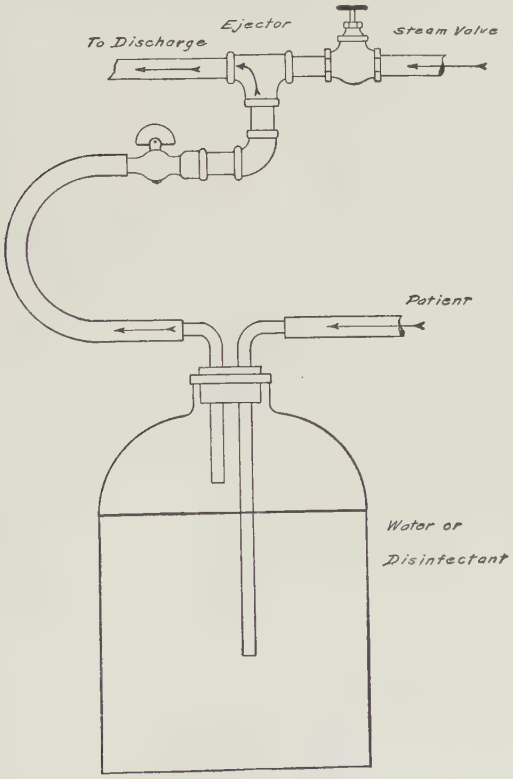


Fig. 15.—An H. D. ejector.

ranged on a low truck of heavy pine, built with cover and solid casters, they may be:

(1) Easily moved forward when needed,
(2) Kept clean and free from dust,
(3) Easily disconnected and repaired.

Ejector.—Provision must be made for evacuating in a cleanly manner large cysts or other bodies containing serous or purulent exudates. If included in the original plan of the engineering department, the room may be equipped with a large aspirating set capable of drawing off several gallons of cystic fluid without letting a drop fall on the floor. The smallest size of "H. D. Ejector" (Fig. 15) does the work very efficiently. It is connected with the high-pressure steam of the boiler-room and discharges "to the atmosphere," into a hopper, etc., by breaking pipe connection.

To the suction opening of the ejector, in the wall of the operating room, is connected a rubber tube leading to a bottle partly filled with water or disinfectant liquid. From the patient's body, at the point of aspiration, is another rubber tube, leading from the needle to the bottle. By opening the valve at the wall the fluid is forced to move off from the cavity by suction, passing into the bottle, where it remains, while any residual air of the system, which may be drawn in at the same time, passes on through the ejector and is discharged to the atmosphere. When the air is all expelled, the cystic fluid follows it "to the atmosphere," *i. e.*, drains.

Waste Receptacles:

I. Unclean, but used over or examined:
   - (*a*) Empty dressing covers—light fiber basket.
   - (*b*) Gloves—basin.
   - (*c*) Brushes—basin.
   - (*d*) Instruments—basin.
   - (*e*) Tape sponges—pail.
   - (*f*) Sheets and towels—hamper on casters.
   - (*g*) Specimens—basin.

II. Unclean, to be counted and destroyed, etc.:
   - (*a*) Small sponges—pail and special forceps.
   - (*b*) Hair from shave—separate basin, not mixed with sponges.
   - (*c*) Tissue—not for examination—basin.
   - (*d*) General waste—pail.

All waste receptacles should be of enamel or fiber, so as to be totally impervious to liquids if required, or to dampness. They must admit of scrubbing with soap and Sapolio and wiping with disinfectants. Hampers should be provided abundantly with white duck or canvas lining washed with each load and always bleached to a snowy whiteness. Pails requiring covers should be operated by the foot only.

Scrub Pails.—When the floor is scoured, the pail of the cleaner should stand on a rubber mat, or have a rubber bottom, to prevent noise and scratches on the tile.

Irrigating Tank.—The large tank for soaking should be covered and kept well oiled and dusted.

Cabinets.—Steam or hot-water pipes conducted through tall narrow cabinets of metal, maintain the proper temperature for Florence flasks of saline which should always be ready for stimulation. These cabinets should be enclosed recesses in the walls, in which the pipes must run.

Instrument Cabinets.—Though referred to here, these should not appear in the main operating room. For a large suite, they may be collected in a special room, in a dry well-lighted place. For a small system, they may stand outside the main room, locked, but of easy access. When an additional instrument is needed during an operation, the shortest possible distance should be taken to get it, boil it and carry it on a tray to the suture nurse.

Elevators.—Similarly, though the elevators do not debouch into the operating room, they must be near, so as to eliminate the effects of drafty corridors. The angles by which a stretcher travels from a fixed table, through the operating-room folding-doors to the door of and then into the elevator must be measured for and made practicable. The elevator must freely admit a stretcher and the necessary passengers accompany it. For fire drill, the elevator should run to the operating room and remain there. The control of the elevator during operations should rest with the operating room, not with the first floor.

The elevator shaft may contain signals for the arrival of operators, audible in the workrooms, or visible, if silent.

Flooring.—The main room should have flooring which will possess lasting qualities, since repairs impede business and impair the usefulness of the institution. The texture should be such that it will withstand frequent washings, scourings, and disinfectants. It must be constantly mopped dry, so that a nurse, whose rubber heels quickly grow smooth, may not turn quickly on a moist spot, sustaining a fall or a bad wrench. For work other than regular operating it may be laid with corrugated rubber mats temporarily. An immense variety of materials is on the market, and the more resiliency can be combined with the above qualities, the better for the nurses. With proper care during time off, resting on a bed, the feet elevated at an angle of 45 degrees, with a minimum of time in the main room, and resilient flooring on the rest of the suite (cork, linoleum, corrugated rubber, wood) the suture nurse can round the corner of the last lap of this service without permanent harm.

Summary.—The keynote of an operating room should be simplicity. This is the basis of honesty, cleanliness and industry.

CHAPTER VII

THE STERILIZING ROOM

"Cleanliness is next to godliness."—*Old Adage.*

Definition of Sterilization.—It is the complete destruction of all organic matter, whether pathogenic or not. Conscientiousness is the essence of this contract. To lessen by one minute the time prescribed for the thermal death-point of bacteria may spell death to some patient. Overtime is wasteful and indicative of inaccuracy. In the case of rubber goods overtiming spoils the material. The arena for the process of sterilizing must be considered as a whole, and each part of the equipment or each method applicable to various types of material must be regarded only as one of many different means to the same end—the patient's safety.

Methods of Sterilization:

Thermal:

(*a*) Boiling—instruments, lying in water.

(*b*) Steaming—utensils, confined in tank of live steam.

(*c*) Steaming under pressure—dressings, rubber gloves, towels permeated but not wet by live steam.

(*d*) Baking—in an oven—suitable for special apparatus, or in improvisation in private house.

Chemical:

(*a*) Solutions—alcohol, lysol, formalin, etc.

(*b*) Gaseous—fumigation with formaldehyd is an aid, but does not sterilize.

Sources of Heat.—For thermal sterilization the different heating agents are singly, in order of merit:

Steam under pressure up to 35 pounds,

Live steam unconfined (longer),

Electricity,
Gas,
Petroleum,
Alcohol.

It is a safe rule to boil all articles that can be boiled. There are combinations of these, *e. g.*, gas and steam.

Preparations Before Sterilizing:

(*a*) Washing—all visible dirt must be washed off gloves, instruments, dressing covers, *et al.*

(*b*) Filtering—water.

(*c*) Chemical helps—washing soda (sodium carbonate) to increase the temperature.

(*d*) Suitable covers—all dressing cases must be double stout muslin, clean, big and clearly marked, uniform in style, neatly and securely folded.

(*e*) Cleaning the sterilizers inside.

(*f*) Cleanliness of persons operating sterilizers.

Mechanical cleanliness must be achieved first. It is absurd to put on the sterilizers the burden of destroying all forms of dirt. The risks run by any sterilizing room are very great and wearing, for the following reasons:

(*a*) The overlapping of duties of many individuals of varying degrees of reliability:

(1) The supervisor's eye cannot always be on the works.

(2) Nurse pupils may have erroneous conceptions of the mechanism of the equipment.

(3) The orderly,
If he has brains, likely has no principles, and
If he has principles, likely has no brains.

(*b*) The goods to be sterilized are full of deadly menace —coming from pus cases steadily, in very short cycles from case to case.

Protection of the Sterilizing Room:

I. All germ-laden material should be cleansed as far as possible by mechanical and chemical agencies before carrying it into the sterilizing room, which is the keystone of the fragile arch of asepsis to be maintained throughout

the suite. In no sense is it a workroom. It must be placed in the plan, in the cleanest portion of the series of rooms. Dust must be excluded. Bundles must be handled with care, on trays, not next the person. Lubricants, liquids, powder, and other forms of "clean dirt" must not remain on goods destined for the sterilizer.

Consider the routes traveled by each type of article, and the means one should take to reduce to a minimum the burden of the sterilizing room and the menace to the patient.

Read going with the hand of the clock—the hours indicate places on these routes.

Gloves laden with pus germs are drawn off in the operating room at 12 o'clock, and are dropped into basins of dis-

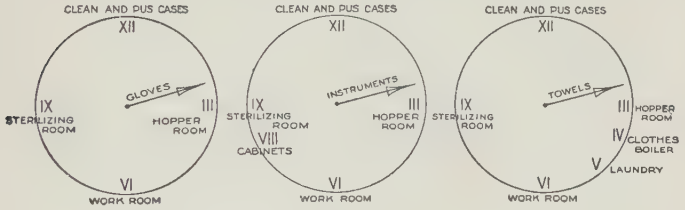


Fig. 16.

infecting solution, preferably lysol, which will not conflict with soap afterward, rendering them innocuous to the nurse who washes them while "alive," though she should wear stout rubber gloves for "dirty" work. This is done in the hopper room at 3 o'clock, out of line of the operating or sterilizing rooms. Many hospitals have had inviting hoppers in the sterilizing rooms, to which, on account of the short distances, all dirt was carried. The hopper room serves as the assembling point for all dirt, to be removed, and to permit forwarding the articles to more powerful cleansing agents. A small set of boilers, and tanks or tubs of disinfectants in this room enable the nurse to send out everything in a condition harmless to others:

The next nurse,
The laundry staff,
The future patient.

These persons must be considered, especially the laundresses, who are ignorant of the death-dealing germ, and are harassed to deliver a daily quota of finished work. If gloves have been boiled and hung on their trees to drain, they may then be moved to the workroom at 6 o'clock, to be sunned, aired, and turned. Vitality of germs is lowered by exposure to the sun and by absence of food. Here the gloves are powdered if required, and done up in sets of three pairs for the surgeon and his regular assistants. This is possible in institutions with stable methods. They are then packed in drums with dressings and sheets for his clinic day, to be wheeled later on a drum cradle into the sterilizing room at 9 o'clock, there sterilized, stored, and later wheeled into the main operating room at 12 o'clock, where a clean case should be perfectly safe with those same gloves that were smeared with pus the day before. Mending occurs in the workroom when required.

Instruments are collected after a dirty case (pus, cancer, typhoid, exanthemata, etc.) at 12 o'clock, in a basin of lysol, carried to the hopper room at 3 o'clock, carefully taken apart, by a gloved nurse, having excrescences brushed off (grease, blood, tissue, threads), then boiled and lifted out on a tray into a large basin of green soap solution. They may then safely be carried to the workroom at 6 o'clock, polished with Bon Ami and alcohol, dried, warmed and oiled at the joints, then laid on the shelves at 8 o'clock, where they rest in their circuit for a while. When needed, they go to the sterilizing room at 9 o'clock, at the last quarter hour of preparation for the clinic also, are boiled and carried on the tray to the suture nurse at 12 o'clock, having no impurity on them.

Towels are collected in sanitary hampers at 12 o'clock, and wheeled to the hopper room at 3 o'clock, where they are put to soak in cold water plus a disinfectant, when

necessary, that will not stain. They stand for a prescribed period, then are brushed with a long-handled brush by a gloved nurse, rubbed if necessary by hand, and thoroughly examined for:

(1) Stains,
(2) Clots,
(3) Tissue, or specimens of value,
(4) Instruments,
(5) Pillows,
(6) Rubber sheets

which have often been carried down, and cause trouble, because

(1) It is wasteful and careless,
(2) It impedes the laundresses,
(3) It reduces the equipment of the operating room,
(4) It breaks or clogs the laundry machines.

(*a*) Towels from a pus case may then be boiled in a small stationary clothes boiler on its own burner, in the hopper-room, if they are few in number, in ratio to the total number of cases handled, then sent to the laundry at 5 o'clock. Every step taken to shorten the journey of infected material pays.

(*b*) Otherwise—they may be tied up in a special sheet, marked "infected," and sent down by the freight elevator to the laundry and boiled at once. They should not be run through the chute, through which "clean" goods must go. By visiting the laundry (without casting any aspersions) a nurse may see the degree of heat used in the machines, and satisfy herself about the amount of disinfecting the laundry does. A large number of workers of the shrewd, maybe, but uninformed class are interested at 5 o'clock, without self-protection against germs, and, on account of living indoors, usually in darkness, moisture and heat, those three friends of the germ, without immunity. Hence the nurses, who know better, should never forward linen that is not disinfected, particularly, too, because the ward linens going out thence are not sterilized.

At 6 o'clock the towels arrive, are straightened, folded, then divided thus:

(1) Wrapped for immediate sterilization at 9 o'clock:
    (*a*) To be used on next day's case at 12 o'clock,
    (*b*) To be laid away in sterile reserve.
(2) Wrapped for reserve in readiness to sterilize in store-room.
(3) Loose:
    For anesthetic room,
    For reserve.

By concentration on these far from vicious circles, and by zealous watchfulness at the sterilizing-room door over all incoming goods, it is quite possible to prevent or stamp out infection. Needless to say, after using so much

(1) Labor,
(2) Heat,
(3) Time,
(4) Skill,

in sterilizing a package of towels, the nurse who handles it afterward must be four times as careful as she might casually think, in order not to drop them or defile them.

II. Goods from a house of contagion or venereal disease should not be brought to the sterilizing-room (*e. g.*, an obstetric bundle).

III. The personnel of those who make dressings should be certified to be clean from tuberculosis or other diseases. These persons may be:

(*a*) Red Cross home nurses,
(*b*) Hospital junior auxiliaries,
(*c*) Probationers.

IV. Goods to be sterilized must be placed in tubes or covers of special design:

(*a*) Glass tubes for packing are made specially with two ends open, so that the steam may thoroughly permeate the entire contents.
(*b*) Covers of muslin are double.
(*c*) Glass jars or flasks should be open, lids inverted, smooth surfaces and rounded corners.

V. The personnel of this room must protect themselves from each other. How to pack a drum is a vital point: (1) A lining sheet or bag; (2) what is needed last is put in first, and vice versa; (3) name of the packer on a printed slip, under lid; (4) date of sterilization on tag outside.

Direct reprimands are the only safeguard for a nurse's future.

Drums must be scoured inside—rust or other chemical compounds must be eliminated, which would act like a foreign body, irritating a wound.

VI. Street dirt must be kept out—floating bacteria should be eliminated, so that packages just withdrawn from the chambers of the autoclaves will not be contaminated.

(1) Galoshes or sneakers for operators.
(2) Heads shampooed—caps at work.
(3) Hands scrubbed, nails trimmed close, run ends of fingers in hard soap before doing dirty work requiring bare hands.
(4) Stretchers cleaned frequently.
(5) Ward supplies done in ward sterilizers if possible—if not, at a special time, without contact of operating room.
(6) Articles on which patients breathe must be boiled, washed, or sterilized by steam, as the case may be.
(7) Visitors must be covered.

The sterilizing room nurse should be more anxious, if possible, than any other person, about the clean result of a hernia.

VII. The room must be entirely cleaned regularly.

VIII. When an infection has occurred, a council should be held, and all the participants in the tragedy questioned and given a fair hearing.

IX. Nurses with tonsillitis, influenza, or infected fingers must be taken off duty. The pupil should be well fed, and given opportunity for exercise, then time deducted for loss of duty. They should dress suitably for the seasons

and keep good hours, conserving their strength and resistance to infections at this critical time.

X. Buy good catgut—do not try to make it—best is from intestines of range sheep, not subject to anthrax—home-made leaves room to blame pupils.

XI. Holes must be mended in gloves and towels. A slit glove should be immediately exchanged for a good one.

XII. If wards are supplied with dressings, there should be a careful system of bookkeeping to show the reason for and the extent of all requisitions, with the return of empty covers. Legitimate expansion must be met. Drainage cases may use a cheaper grade of gauze or cotton.

Principles in Architect's Plan:

1. This room must be near the operator, on account of
   (*a*) Hot water,
   (*b*) Hot blankets and water bags,
   (*c*) Reboiling instruments.
2. It must be out of the line of travel of dirty goods—not a catch-all for pus.
3. It should be on the top floor:
   (*a*) To provide vent for steam, to the outside, visible through glass.
   (*b*) To get the aid of sunshine and breeze,
   (*c*) To prevent its noises from waking or frightening patients.
4. A skylight is beneficial, which permits easy opening, one pane, or the whole.
5. It must have an *EXHAUST FAN* to evacuate heat and humidity, and remove this cause of depleting the nurses' vitality.
6. All fittings must be easily controlled, modern, easily repaired, cleaned, tested, and polished.
   (*a*) Valves in front of autoclaves,
   (*b*) Switches on free wall space,
   (*c*) Cut-offs for
      Gas,
      Steam,

Electricity,

Outside and *inside* the room (room might be unsafe to enter, due to fire, storm, etc.).

(*d*) Pedals for big utensil tanks.

7. Every means to burn, scorch or scald a nurse, and any heavy lifting must be eliminated. Servants should be insured under the Workmen's Compensation Law. Nurses never are.

8. It must be accessible to the night staff so that they may, when necessary, have the water for the day boiled and cooled for early cases.

9. *AN OPEN AIR SHAFT* to a loggia below and to the sky above will provide a vent for the humidity which usually saturates the atmosphere of the main room. If there is another story above, a loggia may be planned there, to create the free passage of air. Two stout swing doors on the shaft, and a light vestibule in the operating room keep the cold out. The shaft is so narrow that a nurse is not chilled, yet it is wide enough to condense all moisture. This keeps up the energy, presence of mind, and endurance of the nurses when engaged in the most important service—at sutures. It reduces the surgeon's perspiration and also the opening of the helpless patient's pores. Humidity robs nurses of their color—they usually look as if they lived in a Turkish bath-house. They are susceptible to diseases of the respiratory tract, for which they stay off duty, reducing their strength and causing the institution expense. Chipping of paint and falling of plaster are checked if humidity is minimized. If the shaft is bounded by the sky, a small roof will prevent rain or snowfall. The gangway between the two rooms requires high balustrades.

10. Flooring should be resilient, to minimize fatigue and headache. It should not be too smooth, for, when wet, it causes sprains and strains, if a nurse turns in a hurry when her rubber heels are slightly worn. Corrugated matting is good if cleaned well.

11. Capacity of equipment (water, dressings, etc.) is based on (*a*) the number of surgical and obstetric beds; (*b*) the relation of wards, accident room, clinic, to this service; (*c*) the possibility of expansion without instillation of this type of equipment in the new sections; (*d*) the probability of emergencies, epidemics, railway or factory accidents. If the hospital is carrying its peak load in ward beds, all services connected therewith should be capable of uniform expansion.

12. The sterilizing room should be open to the pathologist for the severest tests at any time.

Equipment:

A. Water Sterilizers:

1. Blessed be they who give the wards their own sterilizers—main capacity ranging from 6 to 100 gallons—large enough to meet the demands of the institution when carrying its peak load.
2. Set on a solid pedestal, quite high, and out far from the wall, to permit easy handling and cleaning.
3. Two faucets on each, one carried through the wall to the operating room.
4. *Both should contain a cold coil.* No matter how much water has been used, the balance in both can be more quickly heated than *filled, boiled, and cooled down.* The cold coil is of copper coated with pure tin.
5. Must be run every day—water is not sterile after twenty-four hours. It is a good plan to boil early.
6. In small town hospitals which begin with gas, the parts for steam fittings should be installed at the beginning also.
7. Vessels brought to the sterilizers must be sterile, covered with a sterile towel.
8. Must be of pure tin inside.

9. Some firms make water drums with a folding spout, and holding 3 gallons, brought in on drum cradle like dressing drums.
10. To prevent the noise of the blowing off of the steam safety valve, when all conversation is suspended, there is made an automatic steam control valve connected to the steam supply pipe (ditto, if gas).

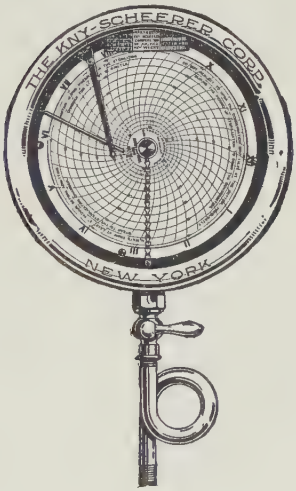


Fig. 17.—Sterilizing-room detector.

11. Every Sterilizer Should Be Fitted With a Sterilizer Detector, designed to keep tab on the consciences of the nurses. (See Fig. 17.) A pen, moved by the varying pressure of the steam, records, in a red ink line, the constancy (or lack of it) of the pressure in the sterilizing chamber where the dressings are, on a dial set at the front of the autoclave, or water boiler. It is encased in glass, and has a lock, of which the supervisor only

should carry the key. The removable papers show the records for twelve hours. Water must be boiled at 15 pounds to the square inch or 250° F.

12. Every steam apparatus must have gages.
13. Sterilizers must be constructed with great strength—the average young girl who operates them has no true conception of the force of steam. The danger from ignorance is equal to that of the germ.
14. Dangers of water sterilizers:
    (*a*) Bursting—must be thick, with sound seams, and allow for expansion.
    (*b*) Blowing off—steam safety valves must be tested.
    (*c*) Leaks—draw off cocks are necessary.
    (*d*) Refertilization—air-filtering valves are required, together with daily boiling.
15. May be boiled up by the night force for early morning work.

B. Filters: There should be two stone filtering bougies, one being scrubbed, cleaned, and aired while the other is in use.

C. Hot Towel Sterilizer: Luxurious fittings, saving the nurse's time—in two compartments, towels above, heated water below, keeping towels hot and moist (tapes for shock, intestinal work, etc.).

D. Utensil Sterilizer:
    (1) Should stand very low.
    (2) Opened by a hydraulic lift.
    (3) No strain in lumbar region when lifting out.
    (4) Boil early, to cool, and not scald the arms.
    (5) Pair of clamps to lift out basins, which should be put in face down, to permit lifting by hand if necessary.

E. Instrument Sterilizer:
    (1) Usually stands too high, and steams the face.
    (2) Pair of clamps to lift out instrument tray.

(3) Add 1 or 2 per cent. borax or sodium carbonate to prevent oxidation on the instruments, to raise the temperature of the water and check discoloration.
(4) Should open with hydraulic lift.
(5) Electrically heated should have automatic cut-off.
(6) Thin layers of muslin between instruments help in sorting kinds.

F. Dressing Sterilizers:
(1) Preferably the autoclave with drums.
(2) Small cylinders, 10 inches in diameter, and 20 inches long (or longer) are preferred by nurses, who, owing to the ubiquity of most orderlies, must handle the drums.
(3) Autoclave and drums are of copper and nickel plated.
(4) Stand made of four legs on a frame shaped like a half barrel, a rolling cradle, acts as carrier for drums, to load into sterilizing chamber or push to operating room.
(5) Low truck helps if rolling cradle is not provided.
(6) Door of chamber must be provided with a ring of packing to close against—coated once a week with graphite to keep pliable.
(7) Best for all if wards can have their own sterilizers, where wounds cannot (easily) be infected.
(8) Damp dressings are not sterile. If withdrawn damp, they immediately can be contaminated by their surroundings, the hand that holds them, the shelf on which they are laid. They should be opened, dried completely, wrapped, and sterilized. (Note, *not again,* because they *were not at all.*) If a nurse finds them damp, she should bravely confess her fault and do them over. There

should be a reserve of sufficient bulk to permit the thorough correction of this mechanical error or carelessness.

(9) Construction of dressing sterilizers:

I. The autoclave consists of:

(*a*) A long cylinder (into which the dressings go).

(*b*) An insulator wrapping it (but invisible).

(*c*) An air space outside of this, of larger diameter, called the jacket.

(*d*) A long metal cylinder outside all—like one small baking-powder tin inside another, and the lid of the larger clamped on.

II. The pressure steam from the boiler-room is turned on into the outer chamber or jacket for a few minutes, and when the gage reads *15 pounds for the jacket*, it is time to draw off the air that was in the chamber around and among the bundles of gauze, therefore the *vacuum valve* is opened. When there is a *complete vacuum* in the inner chamber (of dressings) it is shown on the gage. Close the vacuum valve. Turn the steam into the dressing chamber, at high pressure (17 pounds) for twenty minutes or more after the air stops escaping from the front petcock and the steam shows. The steam must be withdrawn before there is contact with air, or condensation will occur, hence the vacuum valve is opened, and the steam drawn off. This registers "vacuum" on the gage. Then the steam is turned into the jacket, to dry the dressings, at low pressure.

III. The valve dial at the front is marked "vacuum," "steam into jacket," and "steam into chamber," with one lever only to throw over on each—very simple.

IV. The total formula is

"Steam into jacket."

"Vacuum" (in chamber, air taken out).

"Steam into chamber"—twenty plus minutes.

"Vacuum in chamber"—(steam taken out).

"Steam into jacket."

V. Glass tubes for packing should be open at both ends

to permit live steam to rush through the contents with force.

VI. Pressure of steam should not be allowed to go above two atmospheres (30 pounds) as it becomes a gas and is not a sterilizing agent any longer.

VII. Safety device is required to hold the door shut while the pressure steam is on.

VIII. Theory of Sterilization of Dressings.

The germ cell is of albumin, that can be broken up or changed by heat. When albumin is moist, it is destroyed by heat at a low degree.

When it is dry, a high degree of heat is required to destroy it.

Some germs do not bear spores—this type is easily destroyed by a low degree of heat. Some are spore-bearing and require a high degree of heat to be destroyed. To moisten the spore is to prepare it for death in a shorter time (*i. e.*, at a lower degree of heat). Steam is moist heat. At 250° F. (15 pounds' pressure) the albumin of spores is coagulated, hence destroyed. Hence also our fractional sterilization—dressings are "put through" three times, in order to destroy every spore, *i. e.*, to be sterilized.

G. Glove Sterilizers:

(1) Lined with a bag—air squeezed out of gloves, to submerge.
(2) Gloves sorted—good, bad, indifferent.
(3) Must not be laid on radiators or other metal.
(4) Tree used, with prongs, on which to drain (Johns Hopkins style) (made by hospital carpenter).

H. Distillation Outfit: Can be installed in a corner with two faucets—may become cloudy—application of heat dispels—not to be regarded as sterile.

I. Blanket Warmer: To save expense of piping, to have near the patient at the most critical time, the blanket closet may stand in the sterilizing room, or, heated from it, open into the operating room. It is preferable to have no hot closets in the main room.

J. Clock: Alarm set for time sterilizers are due—permits nurse to go to other rooms if necessary—must be watched, and note made on pad in pocket of time goods are entered and to be withdrawn.

Points to Avoid:

1. Burns and scalds to nurses (helpers insured in Workmen's Compensation).
2. Strain and awkwardness in lifting.
3. Explosions, floods, fire from short circuits or frayed armatures.
4. Dripping faucets, leaks.
5. Wet dressings—quick medium for bacteria to thrive in.
6. Mistakes in counting sponges in packing drums.
7. Mistakes in operating the powerful forces of electricity and steam.
8. Running short of cold sterile water—all sterilizing should be completed (+ cooling + drying) before the hour set for a clinic to begin.
9. Dirt on the *inside* of any sterilizer.

Engineer's Instructions:

1. Pupils should be taught the laws of physics relating to water and heat (preferably in high school preparatory work).
2. Construction and working of valves, water-jackets, coils, hydraulic lift, air chamber, air jacket, gage.
3. Engineer makes diagram of the journey performed by the steam reaching into each sterilizer, tracing it on the real pipes.
4. Steam under pressure is hotter—demonstrate this by adapted apparatus.
5. Opening of valve at the wrong step may wreck the whole process and (as dressings are not sterilized) menace the life of the patients.

Supervisor's Duties:

1. Demonstrate operation of all mechanism, and watch the pupil operate all of it till successful.
2. Teach the value and necessity of conscience and

watchfulness. Diploma implies honesty and intelligence and preparation for pupil as future supervisor.

3. No goods should be tied up for long (out of active circulation). One type of case, carefully studied, should have a standardized amount of goods packed, and no more. There should be a large reserve of sterile goods in double muslin covers, upon which to draw. To *concentrate* in the drum all that can be justly expected to be needed, and then to *supplement* with the reserve, everything ever known to be used if necessary, is good management.

4. Inculcate every day the principles of clean work on typical cases like *hernia*.

5. Send nurses to the wards to follow up what should be and is clean, or the disasters from an infection.

6. Swoop down on the sterilizing room at times when the chambers should be evacuated, etc., and note if the pupil is taking steps to do so. Be conscious, even if not in the very room, of the timing of all processes.

Printed Codes.—Here again the need is shown for standardization of all details behind the scenes. The differences observed in formulæ, time, periods, pounds' pressure, *et al.*, bewilder a nurse who visits two or more operating rooms. All directions for manipulating levers, timing boiling, etc., must be encased in glass, framed, printed in bold type, and hung in a conspicuous place, so that "she who runs may read."

(*a*) Tables for the number of minutes, the temperature, or number of pounds of steam for rubber, gauze, iodoform, saline, etc.

(*b*) Dates for inspection, overhauling, exchange, with address of manufacturers.

(*c*) Directions for action in emergencies—flooding, leaks, fire.

(*d*) Management of apparatus daily—less complex, more safety.

(*e*) Materials for cleaning, emptying, filtering, polishing.

(*f*) Guarantee by the company for repairs for a term of years (should always be obtained with purchase).

General Notes:

1. All eye pads, masks, or other special manufactured articles which have contact with the nasal or oral discharges of a patient or of the operating-room personnel must be sterilized.

2. Petri dishes set exposed to the operating-room air show many pus-producing organisms (in one instance 131 to the square inch).

3. Nurse about to handle dirty material should draw her finger-nails across a bar of soap first to fill the space beneath the nails.

4. The sterilizing nurse should protect her branch of the service by being clean and watching others.

5. Washing heads, examination of throats and nasal passages, frequent taking of cultures from all hands just before putting gloves on, strict quarantine of dirty cases on the wards so that nothing from them can find its way back to the operating room, examination of new catgut, cultures from all infected wounds, rigid rules of behavior, will lead to prevention, discovery, or eradication.

6. It is a disgrace for a hernia to be infected—the typical clean case. The pathologist, surgeon, and sterilizing nurse work together to discover the cause.

7. It is a catastrophe to have a series of infections—there seems no excuse for it. The route for gloves, gowns, basins, etc., should be retraced. All materials used in one case should be sterilized and locked up.

8. Always two persons on duty in the building somewhere who understand the running of apparatus.

9. Tap-water is safe in bichlorid tanks, minimizing demand on sterilizers.

Details of Sterilization of Special Materials:

1. Salt—measure, boil, filter three times through filter-paper and cotton—cleanse Florence flasks with green soap and alcohol, fill, plug, boil thirty minutes—then set in dressing-sterilizer for one period.

2. Silk and silkworm-gut—boil empty jars ten minutes, or put through dressing sterilizer for ten to fifteen minutes

at 10 pounds. Boil silk or gut ten minutes, and put in sterile jars with sterile forceps, covering with alcohol 70 per cent.—lids are always upside down in a sterilizer.

3. Suture forceps jar—boil cork and jar ten minutes—fill with alcohol 70 per cent.—only inside kept sterile.

4. Subcutaneous needles—put up with dry goods.

5. Solutions:

Adrenalin, boil one minute—pour into sterile bottle.

Novocain—boil five minutes.

Methylene-blue—boil in flasks ten minutes.

6. Safety-pins and toothpicks—in uncovered jars—sterilize with dry goods—cover before removing from autoclave.

7. Catheters—boil ten minutes, put in sterile towel with sterile forceps.

8. Culture tubes—with dry goods.

9. Dry goods—in autoclave 15 pounds (250° F.)—forty-five minutes.

10. Fractional sterilization for what goes into abdomen or brain—sponges, rolls, etc.

	Pounds.	Degrees.	Time in minutes.	Rest.
First day	15	225	45	Twelve hours for spore formation.
Second day	15	250	30	Twelve hours.

Third day—similar, ordered by some surgeons.

11. Glassware—boil jar containing, and glass goods twenty minutes. Fill jar with 4 per cent. boric acid or 2 per cent. formalin—sterile forceps.

12. Gloves—autoclave—10 pounds—225° F.—fifteen minutes.

13. Rubber tubing—boil ten minutes—put in sterile jars in 2 per cent. formalin. Uncovered jars may be sterilized with tubing in them, in autoclave for fifteen minutes at 10 pounds, then filled with 2 per cent. formalin.

14. Basins are boiled:

Twenty minutes for major operations.

Ten minutes for minor operations.

15. Handbrushes are boiled ten minutes.

16. Filtered water (passed through cotton and filter-paper in a funnel) is boiled thirty minutes in its containers which are previously cleansed with green soap and alcohol.

17. Orange sticks (for the nails) are boiled ten minutes.

18. Rubber tubing—another method—soak in chlorinated soda 1 : 10 for two hours. Wash with soap and water, rinse, boil fifteen minutes. Keep in sterile boric acid or 2 per cent. formalin.

19. Bougies, wash with cold water, and hang in a fumigation cabinet (formaldehyd).

20. For suture table sterilize powder.

21. It is claimed that good knives are tempered at 500° F. and cannot be injured by boiling at 212° F. Rough handling or binding in absorbent cotton injures the edge more than high temperatures.

Looking at the Sterilizing Room from Outside In:

A. It is no use for one branch of the service to make a concentrated, prolonged effort to destroy bacteria in the small number of hospital patients in a large, careless community which disregards personal hygiene, house-cleaning and fumigation, or incineration, after contagion. Municipal Boards of Health should provide fumigating sheds, mattress sterilizers and crematories for infected carriages, mattresses, books, or garments. Public aggregations of infected material must not be brought on the hospital premises.

B. Any business man will say that it is foolish for a hospital to equip a catgut-making plant and man it with pupils who have not enough time to do the nursing the patients require, and will never make catgut afterward. It is EXPLOITATION.

THE DRESSING STERILIZER. ITS EFFECTIVE AND INEFFECTIVE USE

Doctor LeRoy Broun, late Senior Attending Surgeon of the Woman's Hospital, New York City, where, at one

time, the author was directress of nurses, has at my request given me the results of his study of steam sterilization in hospitals. Dr. Broun says:

My attention was first directed to this subject about 1905, when an automatic contact bell, attached to one of the accepted types of sterilizers, failed to function; every effort to make it "go off" under the directions for using this dressing sterilizer failed completely.

The essential for the proper functioning of the alarm-bell was that the circuit should be completed by the contact (through the expansion) of two metal surfaces. This contact occurred at the boiling-point of water, 100° C. This appliance was placed near the bottom of the sterilizing chamber, and the bell was attached to the outer shell of the sterilizer—a most excellent idea, to keep the nurse informed on the continued 100° C. temperature in the sterilizing chamber. On the self-evident value of this information several of these sterilizers had just been sold to a large hospital in Russia.

An investigation by self-registering thermometers as to the cause of this failure showed that the lower part of the sterilizing chamber, where the contact appliance was located, did not reach the temperature needed for contact by the metal expansion, even after maintaining 15 pounds' pressure in the chamber for thirty minutes or more.

A further line of experiments showed that, though the temperature at the top of the sterilizing chamber quickly reached that of steam or boiling water, the thermometers placed midway and at the bottom of the chamber failed to reach this mark even after thirty minutes' exposure, the thermometer at the bottom registering the lowest.

The sterilizer upon which these experiments were conducted was one of the universal type, being fitted with a steam suction arrangement at the top, called an "ejector," for the purpose of exhausting the heated air from the chamber before the live steam is admitted. The effect of this preliminary exhausting process is to obtain in the

sterilizing chamber a partial vacuum of 10 to 15 inches at most, usually not more than 8 to 10 inches.

Since 30 inches represents a complete vacuum at the sea level, it is evident that fully one-half to two-thirds of the residual heated air still remains in the sterilizing chamber and in the meshes of the dressings, etc., contained therein.

As to the effectiveness of dry air as a means of destroying bacteria and their spores, many experiments have determined that superheated air will not destroy the spores of pathogenic germs in blankets even after a three-hour exposure at a temperature of 133° C., and that it requires four hours' exposure at a temperature of 140° C. for the destruction of anthrax spores.

On the other hand, it has been equally shown that boiling water and live steam quickly destroy all spores and bacteria, only four minutes being required to destroy anthrax and its spores, and a less time for other pathogenic organisms and their spores.

With this knowledge before us, we readily see the importance of not only freeing our sterilizing chamber and the meshes of all the dressings (in process of sterilization) from air, but also, by accomplishing this, of getting the desired uniform temperature of 100° C. throughout the entire chamber—even to the center of our dressing packages and drums.

The residual air in the meshes of dressings from ineffective removal will prevent these areas from reaching the desired temperature and also cause the sterilization of these areas to be unreliable, on account of the ineffectiveness of heated air except under prolonged exposure, as spoken of above.

Dunham, in an excellent article on the physics of steam sterilization, clearly brings this out in an admirable line of experiments.

For the purpose of driving all of the air out of the sterilizing chamber and its dressings a most effective and absolute method is that of *utilizing the steam of the ster-*

ilizer, and not depending on the "ejector," which is shown to be most ineffective.

In all sterilizers the steam should be delivered into the top of the sterilizing chamber by a tube having its opening at the distant (back) end of the chamber. Steam streaming through this opening will drive the air before it, even from the minutest meshes of all dressings and packages.

A stop-cock should be placed in the lowest position of the door of the sterilizer, and should be left open. If a rubber tube is attached to this open cock with its free end placed under water, the bubbles of the expelled air mixed with steam, as it is driven out, will be easily noted. After all the air is expelled and only steam escapes, the water-hammer sound—caused by the condensation of the steam in the cold water—is heard on a smaller scale, but similar to that heard at times in steam pipes. When this point is reached the entire chamber—even the center of the heaviest drums and of the dressing packages—will all register the same temperature of 98° to 100° C.

If the pressure is raised to 15 pounds or more, the temperature will be correspondingly higher.

Since superheated steam **confined** takes on the qualities of dry air and loses its rapid effectiveness for the destruction of bacteria and their spores, it is important that the cock in the door should be left partly open—during the sterilization—in order that the steam shall be **streaming** in character and not have the ineffectiveness of dry air.

As a result of our experiments we have found that all the air is expelled from the chamber by this process in eight to ten minutes in the ordinary sized sterilizers. On this basis, the rule of *allowing the steam to escape freely through the door pet-cock for fifteen minutes before the timing of the sterilizer is noted,* has been adopted. The pet-cock is now partly closed for the purpose of maintaining the 15 pounds' pressure or more—and the timing of the sterilization begins.

CHAPTER VIII

MINOR OPERATING ROOMS, WORKROOMS, AND ACCESSORIES

Reasons for Minor Rooms.—The make-up of an entire operating suite is based on the nature of the surgery which is presented by the community. In residential suburbs are found much

(*a*) Preventive surgery:
Adenoids,
Tonsils,
Circumcisions,
Submucous operations.
(*b*) Plastic surgery:
Hernias,
Gynecologic repair.
(*c*) Emergency surgery:
Brain (auto accidents),
Fractures.

In purely industrial centers there will be
Amputations,
Genito-urinary operations,
Gynecologic infections.

A council of all persons concerned, studying the plan of the suite by the light of past history and with a forward outlook to expansion, should make a strong bid for doing all work hitherto attempted in the homes or done in some metropolis, or deferred forever. Division into clean and septic, light or dark, large or small, must be arranged in council. Climate and topography cause certain tendencies leading to a full harvest for specialists in those forms of surgery. The hospital must study its parish, and its needs, and try to equip for them, within the bounds of reasonable outlay and consequent fees.

Special Rooms for Single Types of Surgery:

A. For all "scopic" work, or operating with aid of a headlight, requiring simple equipment, concentration of skill on one small or obscure area, few dressings and few assistants, a small room is best. This is justifiable also on the score that these patients are guests of the hospital for one day only, and are not emergencies, therefore do not hold up the main room more elaborately equipped for a wider scope. For example:

Tonsil Room:

Special rheostats, transformers, and other fixtures (surgeon),
Frosted bulbs or ground glass, flexible droplights (nurse),
Fumigating cabinets for non-boilable apparatus,
Separate instrument cabinets,
Facilities for obtaining ice (hemostatic),
Special rubber sheets, stout restraining sheets,
Large wide-mouthed buckets,
Suction apparatus to evacuate blood in throat,
Tonsil table—raise to sitting posture—seat of corrugated rubber matting to prevent slipping.

B. Of all the organs of special sense the one most valuable, most delicately sensitive, most frequently infected, and in its loss causing most damage and personal regret is the eye.

Eye Room (operation, not treatment):

Special tables,
Electric fixtures (for emergency night work), transformers, etc., for "scopes,"
Magnet to draw out foreign bodies of steel or iron,
Extreme cleanliness without many disinfectants,
Cabinet of eye instruments—special method of sterilizing,
Special dressings—eye pads, masks, shades,
Local anesthesia usually,
Natural light for day work—must be good and generous,

Suitable methods for marking, reporting, and recording—**no mistakes must be made** (*e. g.*, enucleating good eye).

C. When a patient is septic or venereal, it is not fair to contaminate the main room where a clean case follows. Puerperal sepsis is one of the most insidious foes of a hospital. The expense of equipping a septic room is justified by the sense of security felt by the authorities and communicated to patients.

Complete equipment—nothing ever taken out of this room to be used elsewhere—nothing lent to it from clean room; must be given and remain.

Boiling, disinfecting, thorough, after each case, so that it would really be safe for a clean case every day.

Careful diagnosis on patients assigned there.

Isolation of patient afterward for consistency.

Separate nursing force.

Separate exit.

Capable of being sterilized by live steam.

Workroom:

1. The room in which clean dry work is done
   Dressings,
   Plaster bandages,
   Mending gloves

should be large, light and airy, to preserve the nurses' health and increase their output.

2. Each nurse (4) should have her place to work at, and each sort of work should be done in a fixed place, kept tidy by her in charge.

3. Windows should be modern in design, to admit air without drafts, and abundant light—always screened.

4. Flooring should be very resilient, of rubber, or cork, or battleship linoleum, to rest tired feet, and cause no noise; also easy to clean, on account of the enormous quantities of lint and fluff.

5. The walls are lined with cupboards to contain raw goods opened for work—doors plainly labeled.

6. The head nurse needs a substantial, well-appointed desk, with locked drawers, for

(*a*) Patients' valuables discovered by the anesthetic nurse,
(*b*) Operating-room records,
(*c*) Nurses' record cards while on this service,
(*d*) Personal effects.

7. First class lighting fixtures are to be provided, especially lights directed *into* cupboards, or *in* closets, and a very good lamp for the head nurse's desk. Use light generously at work, but not extravagantly (fines).

8. A spindle on the desk holds all memoranda relating to

(*a*) Interns' messages regarding cases,
(*b*) Supplies needed,
(*c*) Repairs found needed by pupils,
(*d*) Time-off for nurses,

and this should be cleaned off (executed) daily.

9. A long, low, heavy deal counter stands in a well lighted, convenient place, with its surface always scrubbed spotless, and a bar underneath on which to rest the feet. It should be marked off in the sizes of gauze required for certain dressings, such as used by the American Red Cross war workrooms.

10. Gauze cutting should be done by machine (by an orderly or porter, if possible), similar to the type used in clothing factories.

11. For seats place heavy solid kitchen chairs made with a comfortable slant, so that the knees may go under the counter.

12. Footstools and stepladder must be provided to reach the top shelves of cupboards—all these should be shod with rubber. Small stools have a hole in the center to lift them by.

13. Sewing-machine run by motor is very necessary for mending in limited amounts, left-hand end at a window. Thimbles, needles, and thread in a basket.

14. Electric iron, and patent collapsible ironing-board

permit pressing out clean dressing-covers or mended articles—not for nurse's personal use.

15. Miter box, bandage knives, bandage rollers in convenient places, with baskets (in nests) to contain cut bandages.

16. Large assortment of bags as containers, hung on hooks at table or wall.

17. A set of tea things or a coffee percolator will prove a good investment. If the nurses avail themselves honorably, of this privilege, the benefit of the stimulant will show in a garrison finish to a long, hard day. There should be no odor of coffee when patients and visitors are about.

18. Thick glass slab on the table to make medicated dressings will save cleaning the deal table (boroglycerite tampons or iodoform gauze).

19. Stationery consists of:

(*a*) Operating-room report slips,
(*b*) Chart leaves (for surgeon),
(*c*) Sets of labels,
(*d*) Nurses' signatures to drop into drums or infusion sets.

20. Cutlery, including knives, scissors, kept free from rust, and sent regularly to be sharpened with the instruments.

Hints on Management of Workroom:

1. Do all one kind of work at one time.
2. Keep everything in its place.
3. Clean up thoroughly at night in such a manner that work may be instantly resumed in the morning.
4. Avoid continuous conversation and permit no intimacies to be formed.
5. Allow no visitors (physicians, special nurses, or patients).
6. Dust the workrooms with damp dusters to keep down fluff.
7. Alternate sitting with standing work—when sitting keep the feet off the floor, on a bar.

8. Nurses should address each other as "Miss A," "Miss B"—never by the Christian name or the surname without the prefix "Miss."

9. Keep one nurse on duty in such a place that she can easily

(*a*) Answer the telephones,
(*b*) Present a good appearance,
(*c*) Answer visitors' or passing surgeons' inquiries.

10. There should never be fewer than two nurses on duty, especially if engrossing work is going on, such as washing out blood and clots, or timing the sterilizers.

Hopper Room.—The hopper room should be equipped with first class plumbing fixtures, fool-proof against being stopped up with all the articles and materials carried to this room, which furnished food to the engineers for so many bitter complaints, in the past, when all the grounds had to be torn up sometimes, tracing the cause of overflows, till they said "they took everything out of the drains but a nurse."

(*a*) Hoppers for washing utensils, with spray—nothing to go down but water.

(*b*) Hoppers for cleaning clots or other dirt which must go down—good trap.

(*c*) Tubs to rub linen on washboard, to remove fecal stains, etc., plugs at bottom.

(*d*) Tubs to soak linen in disinfectant—stoppered.

(*e*) Stand to clean blood or pus off instruments, with basin and drain.

(*f*) Good washstands for nurses, so that they may feel clean when through with the dirty work of the hopper room.

(*g*) Lockers for each worker, with tools, mops, dusters, brooms, brushes, pails, Sapolio, etc., always washed, boiled, and sunned before putting in, with

(*h*) Special ventilation, drying and heating apparatus, so as to prevent the heavy dank odors of mops, linen, etc.

(*i*) Sanitary flooring that will absorb no odors and yet not cause sprains and falls, or remain wet.

(*j*) Printed codes for disinfectants: (1) Tanks of linen; (2) utensils; (3) instruments; (4) gloves.

(*k*) Laundry chute from hopper room. When wet wash is sent down, a loud bell in the laundry, wired from the hopper room, rings a warning to take it at once—not necessary for dry wash. Chute must be water-proof and hosed out frequently.

(*l*) Modern contrivances to hold brooms and mops on walls, and to wring mops; also wire doors only, on lockers, for ventilation.

(*m*) Lockers should be movable and sunned—not built in.

(*n*) Racks for drainage-tubes, with pan below, not to wet floor.

(*o*) Light trucks or hampers on wheels, lined with laundered bags, for soiled linen.

Store Rooms.—Of these there are usually too few, and without design. Just as the kitchen is the most important part of a house, requiring the most ingenious planning and equipment, so the workrooms (including the sterilizing room) are the most important to the nurses, therefore to the hospital. Whatever facilitates a nurse's finding or caring for materials helps the hospital.

In the storage rooms should be:

1. Stepladders and stools of varying heights.
2. Shelves in cupboards with (*a*) solid doors; (*b*) wire screen doors.
3. Counter—to measure only what is required in workroom (saves hauling).
4. Precautions against mice eating shellac on bougies, etc.—metal drawers being best safeguard.
5. Good lighting fixtures—to enable finding small objects quickly.
6. Careful division into compartments that equal in number the types of goods handled.

7. Careful wrapping in flannel, cotton, tissue, etc., of expensive instruments.

8. Regular inventory and checking off of invoices of goods.

9. Perfect system of labeling.

10. Regular inspection and housecleaning.

11. Heavy goods include gas and oxygen tanks, utensils in reserve, parts of the operating-room equipment, etc.

12. Gauze and cotton room hold 1000 yards of gauze +, or 50 pounds of each grade of cotton +, according to the number of surgical and obstetric beds. To order once a month is usually satisfactory.

13. Sterile and unsterile reserve room should be seldom entered, but built with good ventilation and lighting.

Dressing Rooms for Orderlies.—The orderly should not go through the house in his "duty" clothes. He needs a small dressing room with toilet, so as to prevent the possibility of his visiting others.

Nurses' Dressing Rooms.—The strain of operating-room work is so great that nurses must sometimes go without proper rest. Hence, any comfort that can be given by proper quarters in which to clean up, put on gowns, freshen one's appearance, in a secluded manner, will be "for the good of the service." They should be warm, well lighted, and equipped with shower, mirrors, wash basins, modern toilets, coat hangers, clock, hooks, and chairs.

Doctors' Dressing Rooms.—Add ash trays and Yale locks.

CHAPTER IX

ASEPSIS

"This is the cat that ate the rat that ate the malt that lay in the house that Jack built."—*Old Tale.*

Definition of Asepsis.—Asepsis is defined as the absence of pathogenic micro-organisms. In a different word, it means freedom from disease-producing germs. This condition splits into two parts. It must be

I. Created by boiling, steaming, fumigating, or disinfecting with chemicals; then

II. Maintained by clearly understood operating-room methods, *relatively* for one patient at a time—*not absolutely* for all time or for a whole clinic.

Asepsis rests on the foundations of conscience and intelligence.

The creation of the condition has been treated under the head of Sterilization. But things do not remain in a sterile state. When one broils steak, it remains broiled and never becomes raw again. But when one boils a knife or tube it does not remain "boiled." The slightest breath or touch "unboils" or unsterilizes it.

Asepsis often seems to spell inconsistency to a bewildered novice. Substitute the word "safety." The maintenance of safety to the patient on the table depends on several factors:

I. *Site of Operation:*

(*a*) Eye:

(1) Exposed to the elements, to dust, to handling, to dangerous contacts with others in poor or congested areas, by towels.

(2) Too delicate in structure to disinfect with chemicals.

(3) Has enough resistance to combat a moderate amount of infection.
(4) Helped by sun and air.

(*b*) Throat:
(1) Crypts full of filth all the time.
(2) Accustomed to decay of food, intake of floating bacteria, etc.
(3) Develops some immunity.
(4) Will be exposed to same dirt again after operation.
(5) Helped by sun and air, and mechanical washings with liquids.

(*c*) Abdominal cavity and bone—or joints:
(1) Periosteum and peritoneum most delicate structures—highly susceptible to infection.
(2) Favoring growth of bacteria—darkness, moisture, and heat.
(3) Never exposed to the enemy—never put up a fight—have no resistance—developed no immunity.
(4) Have no daily flushing with liquids as in mouth—get no help from nature.

II. *Virulence of Germs if Introduced.*—Germs vary in virulence. It is much easier to kill some than others. The germs of

Tuberculosis,
Anthrax,
Puerperal septicemia

are very hard to destroy, but they are not likely to be found among the floating bacteria of the operating room or on the door knob a careless nurse might touch. A person coming from the tuberculosis patient to the operating room builds a barrier of safety for himself first by personal hygiene. A nurse must use common sense combined with honesty, and not develop a "phobia" about germs, on the principle that, by and large, in so many places, much less clean than the operating room, wounds

are made and healed. To develop a balance sense of safety to the patient the nurse leaves all her actions open to criticism and advice, but thinks constantly of each step and its significance.

III. *The Germ's Own Choice.*—The diphtheria germ prefers the throat, vagina, or blood-stream. There are others which prefer the brain and cord, leaving an abdominal case safe.

Preparation of the Nurse to Comprehend Asepsis:

I. Lessons in Bacteriology: A. Theory: (1) The nurse has attended lectures on bacteriology. (2) She visited the laboratory and saw bacteria moving on the slides under the microscope. (3) She sees on the wards types of cases of bacteria of greater or less virulence. (4) She hears with awe the history of some tragic case becoming infected. (5) She learns the varying methods for the destruction of germs according to their degree of virulence, thus learning the relativity of the maintenance of asepsis.

B. Practical Application to Operating Room: (1) Cultures should be taken from her hands *scrubbed*, *unscrubbed*, and *after handling infected material*, and shown to her. (2) Cultures should be taken all along her trail: (*a*) after handling infected material, *i. e.*, off whatever she touches, to show that she can transmit another patient's infection; (*b*) after touching door knobs, faucets, etc., previously touched by an unscrubbed orderly or person from the street. (3) Dandruff, scarf skin, dust should be injected into a guinea-pig to show their danger. (4) Alien blood also as per all tests relative to transfusion. (5) Cultures finally from the whole operating-room force when it is at concert pitch, from saline, dressings, hands, rubber tissue, etc. (appalling when seen next day) to show that our best is not perfect. We cannot totally eradicate the menace because it is hard to control every act of the entire personnel. Some hospitals have a monitor to watch for "breaks." Everyone should be on the "qui vive."

C. Physical culture for nurses. Straight front—no

debutante slouch—no bumping into sterile tables—no miscalculation of distances. On this service a nurse should have a delicate set of antennæ in her nervous system warning her when she approaches "red-hot" (sterile) goods. She must think with her cap, her elbows, the ties of her gown, knowing how wide is the margin of safety to keep away from the suture nurse, the tripods with basins, the sweep of the operator. By standing in a soldierly manner with the abdomen drawn in one avoids rubbing against what seems far enough away from the eyes.

D. Ethics may be constantly inculcated by the true supervisor who builds for the future strong self-reliance of her pupil.

E. Anatomy and physiology are constantly drawn upon in teaching the reasons for the extreme delicacy of structure and susceptibility of joints and deep abdominal cavities.

The maintenance of asepsis is quite like good table manners. One handles articles with tools—the work is waist high, above the table—one does not carry a dish with the thumb over the edge of it—one does not scratch one's nose—one keeps one's elbows reasonably close to the sides—one does not put into the butter dish a fork that has passed one's lips. It would be interesting for pupils to draw charts of their ideas of maintenance of asepsis in the first and last weeks of their service.

Charts of Trails.—The supervisor's morning preparation for the day's list should include outlining, for each group that come to this service, a chart of the germless journey of the

Gloves,
Gowns,
Towels,
Sponges,
Instruments,
Silk, etc.,

Charts of Barriers of Safety:

I

Menaces		*Barriers of one degree of safety*		
		Against		For
Pus dressings elsewhere by Puerperal septicemia treated by Street germs carried by Possible mild bronchial or throat affections of	Surgeon and his assistants	Head Perspiration Breath	Mask and cap or helmet	Patients' wound and respiratory tract
		Hands	Gloves, overlapping sleeves	
		Form	Gown to knees with long sleeves	
		Feet	Galoshes or sneakers	

II

Menaces		*Barriers of three degrees of safety*			
		I	II	III	
Instruments	Used on pus cases previously. Lying in hopper room where all dirt of suite is focused.	Boiled prescribed time	Lifted out on a tray	With forceps, with boiled ends (nurse not leaning over)	And carried to gloved suture nurse.

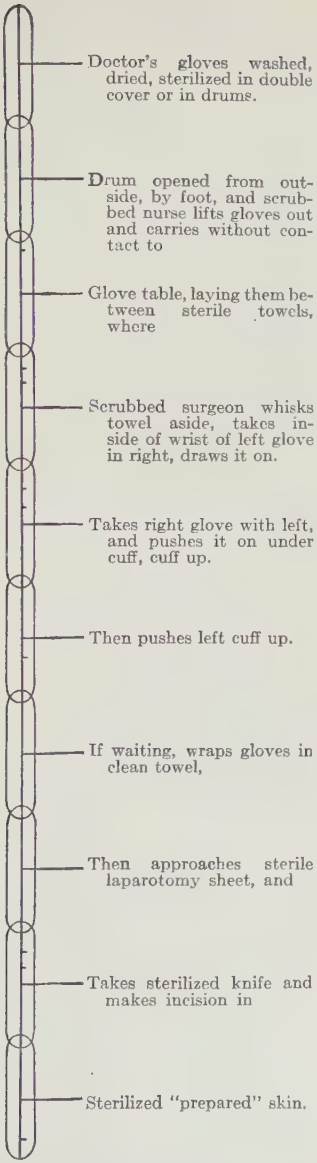

Doctor's gloves washed, dried, sterilized in double cover or in drums.
Drum opened from outside, by foot, and scrubbed nurse lifts gloves out and carries without contact to
Glove table, laying them between sterile towels, where
Scrubbed surgeon whisks towel aside, takes inside of wrist of left glove in right, draws it on.
Takes right glove with left, and pushes it on under cuff, cuff up.
Then pushes left cuff up.
If waiting, wraps gloves in clean towel,
Then approaches sterile laparotomy sheet, and
Takes sterilized knife and makes incision in
Sterilized "prepared" skin.

Fig. 18.

III

"TOUCH NOT" CASES

	Menaces in bone surgery	*Barriers*	
Even new gloves may have been contaminated with virulent germ in factory, on shelves or in ordinary handling.	(1) Gloves dry sterilized—low degree of heat. (2) Danger of pricking and letting blood or perspiration escape, or (3) Liquid off hands only scrubbed (not boiled).	Instruments only to touch the wound—they can be brought to higher degree of heat **inanimate.**	Patient's wound

IV

CHART OF CIRCULATING NURSE'S DUTY

	Menaces	*Barriers*	
Circulating nurse	Head—dust, dandruff, loose hairs.	Helmet or close-fitting cap.	Taken by gloved suture nurse off tray, not with forceps.
	Breath—throat germs.	No talking.	
	Person—	Gown.	
	Feet—	Hospital shoes.	
	Hands—clean.	Does not lean over—holds tray out.	

V

BACKWARD JOURNEY OF UNUSED STERILE GOODS FOR FUTURE PATIENTS

	Menaces	*Barriers of Safety*	
Patient on table Surgeon Two assistants	Form one group that menace with their touch anything for another case.	(1) Gloved suture nurse never touches patient on the table, nor anything that has touched him. (2) She drops what the surgeon needs on his tray. (3) She receives nothing back. (4) She can at any moment demonstrate free air space all around herself. (5) There is a distance of about 3 feet, and nothing from the group could or should fall on the suture table. (6) She opens jars aseptically and puts clean goods back with forceps.	Future patients

Floating Menaces	*Barriers of Safety*	
Loose hairs Dust in head Dandruff Perspiration Talking—breath—throat germs Coughing and sneezing—sinus or chest germs	Cap and mask or helmet mask.	
Dust on high fixtures:	(1) Reduce high equipment to minimum. (2) Good dusting often. (3) Ground glass plate slung under lights. (4) Covers or radiators to prevent dust in currents along floor to radiators, dried, and ascending from them. (5) No roller shades on skylights to darken room. (6) Live steam turned on in room after pus cases.	Patient's open wound
Stands and cases:	Cleaned—covered with towels—pulled out from wall and dusted at back daily.	
Floor:	Exclude unnecessary persons—tetanus on soles of shoes. No ward nurses. Instruments sterilized before putting on shelves. Mop floor with soap, then carbolic acid solution. Nurse wields mop during case, as blood is a fertile medium for germs.	
Ventilating fans:	At rest during progress of case.	
Chipping of paint:	Frequent cleaning, inspection, renovation.	
Untrained persons:	Physical examination of orderlies. Keep out orderly and maids during case. Watch and train and prevent them from doing harm. Provide with caps and wash suits, plainly labeled "orderly," to wear only in this suite, not to dining rooms.	
Anesthetist's person:	Cap, mask, gown, screen-cover with sheet for close-ups—no street clothes.	

to the patient, used on him without being contaminated by anything outside of his field of operation.

Materials that are not needed and could be used over again for another case are dealt out sparingly from the suture nurse's table, and as she keeps clean, she may put only what did not leave her table back in the jars, as each patient's blood or secretions are menacing to succeeding patients.

We must, after sterilizing an article, avoid any act which will render that sterilization useless before it reaches and is used on the patient. Asepsis being maintained means the construction of a long chain of honest, intently thought-out acts.

When the surgeon makes the first nick in the skin, *sterility ceases, but asepsis must be maintained.* All participants combine to prevent anything alien to the patient at the field of operation from being introduced there by touch, breath, falling out of the atmosphere, etc. But the patient's blood-stream may contain Spirochæta pallida, typhoid bacillus, or Streptococcus viridans, which faintly smeared in the wound of another would soon kill him. No scrubbed up person should say "I'm sterile" after the subcutaneous tissue is exposed. He would not rub a raw wound of his own along that open surface.

Circulating nurse does not touch the ends of the forceps *that* lift the tray *that* carries the instruments *that* the gloved nurse drops *that* the surgeons use.

Floating Bacteria.—This includes all dust or falling particles acting as a vehicle for bacteria. Note that surgeons and nurses don helmet or cap first, so as not to shake dandruff down on gown.

History.—In earliest times surgeons operated without knowing that germs existed. The good results they did obtain were due to the hardihood of the race, and the absence of some virulent bacteria stimulated by congestion or civilization (so called). Later on efforts were gropingly made toward cleaner work by disinfecting the air and equipment; still results were meager. Only in

our own lifetime has asepsis been practised, but the results are marvelous. Yet we may be at the peak now, and decline, because the personnel of olden days showed desperate anxiety, endurance, kindness, and concentration

Fig. 19.—Opening towel properly folded (to the center twice).

of effort to save the patient, while now, as we become pleasure-seekers, engrossed in plans for our own comfort, we undermine the scientific skill of the surgeon and pathologist, who build up the delicate sensitive structure on which they have to rely. One nurse's "little(?) white

lie," acted or spoken, can wreck the whole fabric, injuring the professional standing of surgeon and hospital. It is gravely necessary to lay emphasis upon constant truthfulness in all our educational schemes. Otherwise only

Fig. 20.—Laying a sterile towel by the field of operation, opened only after passing the surgeon.

the grimmest prophecy can be made for the operating-room results of 1934. The only way to train a nurse to be "conscientious" is to be close to her and to know intuitively as well as to see that she works honestly.

Definition of Technic.—This word has unfortunately been written into the nurses' argot. It must be left to its proper place, *i. e.*, the anatomic procedure of surgeons in type operations; where to cut—how long the incision—when to ligate—or excise—how to dissect, etc. The technic of a violin virtuoso consists in his mechanical style of execution of the scientific knowledge of scales and chords—following a set piece. The sentiment he puts into it corresponds somewhat to the natural acute diagnostic sense of the surgeon. There cannot justly be said to be a "break" in technic. The nurse may make a "break" in the aseptic chain.

Break in Asepsis.—If any scrubbed person inadvertently touches an unsterile object, such as the outside of a dressing cover, or the circulating nurse's gown—on advice of counsel, she should

(1) Wash her gloves in alcohol + sterile water, or
(2) Change her gloves, or
(3) Drop out, as the case may be,

counsel deciding the degree of necessity, as,

(1) The article touched likely carried no pathogenic micro-organisms (or few).
(2) Such as were there may be destroyed by moderately powerful disinfectants.
(3) The operation should not be delayed if the patient is in poor condition due to
    (*a*) Longer anesthesia,
    (*b*) Longer exposure of intestine.
(4) Of two evils, the less is chosen, *i. e.*,
    Effort at hasty disinfection.
(5) The patient's degree of resistance to some moderate degree of infection is known to the surgeon.

The supervisor discussing points of this sort is spending these moments well. Hurried replies, incomplete explanations, leave much to the pupil's untrained imagination. Probably she becomes callous to these niceties of honor. A safe rule is "take nothing for granted."

The Pin.—When pins are removed, a package is considered unsterile. Who knows what hand has opened and uncovered the dressings, handled them, and rolled them up again? The pin is buried in one insertion—no part exposed but the head.

Wrong method.

If the *out* were smeared with red ink, and the pin quickly withdrawn, there would be some redness on the dressings inside. Similarly, if the "out" were contaminated when handled by unscrubbed hands, the withdrawal of the pin would infect the contents. Some institutions use no pins, simply rolling the fourth corner inside tightly, especially in drums.

Preparation of Nurse for Assisting at Operation in Private House.—For many reasons operations may have to be done in the home: (*a*) Contagion; (*b*) patient cannot be moved; (*c*) patient too far away from hospital; (*d*) patient afraid of hospitals; (*e*) privacy essential; (*f*) patient's choice of operator not permitted use of nearest operating room.

No matter what the relation between operator and hospital, a graduate nurse must say nothing to divorce the patient from the operator of his choice. If conditions are such that she cannot tolerate them, in the light of her conscience, she should ask to be relieved. In a private house, with "no anything" of a technical nature, the nurse must make haste, filter saline, clean the room, etc., and being alone, she may open as many packages as needed before she scrubs. Hospital training should equip for competent private work. Every directress of nurses should do two years of private work so as to know for what she is training her pupils in future.

To assist a doctor alone, she may take out the contents of packages with a long uterine dressing-forceps, kept in lysol $\frac{1}{2}$ per cent. without scrubbing up herself, or may lay them per forceps on the table in generous quantities.

and then scrub. Where duties are not clearly circumscribed, some nurses are too ready to get into a sterile outfit and then ask for slavish attendance. The scrubbed nurse should defer putting manacles on herself till the latest moment, and should do all she could alone, both before and after. Her brain should plan all ways to prepare layouts, to "make the room safe for asepsis." "Every tub should stand on its own bottom" is a true though homely adage. Forethought and self-reliance are two things thus developed which "this sad world needs."

Directions for Scrubbing Up.—*Nurses' Scrub for Laparotomy.*—Place soap bottle, brush, and orange-wood stick under running water in a basin controlled by a pedal. Soap the brush and scrub each arm to the elbow half a minute. Rinse. Soap brush, and scrub wrists, backs and palms of hands, knuckles, finger-tips, and between all fingers very thoroughly, with a stout lather, following the outline of the whole hand and both surfaces. Clean nails, push back cuticle, soap brush, scrub, and rinse. Soap brush and scrub hands all over for one minute more. Total eight minutes. Rinse under running water. Never touch stand. Make paste of lime and soda and rub in well up to elbow one minute. Rinse. Soak hands in $HgCl_2$ 1 : 5000 two minutes. If the soap is not entirely rinsed off, the nails grow brown and the skin cracks. Some hospitals disapprove of the brush on a nurse's arms above the wrist, which makes the skin susceptible to bichlorid rash and renders her unfit for duty.

Tonsil Scrub.—Scrub hands and wrists with soap for three minutes in running water. Rinse. Soak in bichlorid 1 : 5000 for one minute. Brushes of medium fine hair, never fiber.

General Addenda:

1. Solutions must not become clouded. Scrub up stand kept wiped up. Fresh solutions.

2. Brushes washed and boiled after each case—thoroughly sunned or dried in driers. Plenty of brushes, sunned, cheaper than a few, dried by drier—saves bristles.

3. If a nurse has to wipe perspiration off a surgeon's face she winds a clean hand towel around her right arm spirally to leave no loose end, and as he leans away from the table, she wipes very firmly and slowly, with deep, systematic strokes, not faint, tickling dabs. (See Fig. 4, p. 40.)

4. Operator's glasses must not be disturbed. If they are spattered with blood from a spurter, the nurse should remove them instantly, wash in cold water, then alcohol, to disinfect and polish.

5. Keep ready boric acid and argyrol in case of pus in the eyes.

6. The variance in time limits for sterilizing goods is due to the varying durability of goods, mildness of bacteria, and amount of resistance of the part where used.

7. Breaks in maintaining asepsis can be made by others than nurses, *e. g.*, by the assistant if he lets the laparotomy sheet sweep the floor. It should be discarded.

8. In wiping the abdomen with iodin, the umbilicus is done last of all, and the sponge stick discarded.

9. When a nurse sets up alone, she may lift a basin out by the under surface and support it from below at the faucet, or fill it afterward by a pitcher.

10. Germs travel through moist goods. Covers must be entirely removed from a table which has had contact with the patient. It is not enough to peel off the top layer. For every operator there should be two covers on the suture table, thick first to protect glass from heat and to deaden sound, thin on top.

11. Suppose the surgeon used a side table, it would have to be washed, and wiped with 5 per cent. carbolic acid, then dried before using for a second case.

12. No lower shelves should be used. The awkwardness is dangerous.

13. The room should not be set up too long before operation. There should be a standard ruling. When a floating night nurse comes on duty at midnight, she may

set up about 7.30 A. M. for early cases. Sterile goods do not remain so if opened for a long time.

14. No person on the force should approach the suture table except the suture nurse.

15. A clean case is that which will not menace the operating room, and in which we expect normal temperature and primary union. It is usually sewed up tight. Such would be gynecologic repair, appendix in interval and not ruptured, plastic work, fibroid tumor of uterus, compound fractures, etc.

16. In a clinic the clean cases come first, *e. g.*, gastroenterostomy.

17. All apparatus for the anesthesia room should be changed and sterilized. It is just as harmful to transfer tuberculosis bacilli per os as to carry external infection to the abdominal cavity. Coughing may ruin a hernia operation.

18. If jar lids must be laid down, they are laid top down.

19. Instruments used for amputation within the abdominal cavity, *e. g.*, to cut off appendix or sever pedicle of a cyst, are discarded with the specimen.

20. Towels in contact with pus or malignant growths that bleed are gathered and soaked in disinfectant.

21. The operating table should be washed and whitened, then disinfected in all crevices daily, and after discharges from dirty cases.

22. Shoes—to secure efficiency the head nurse will watch that the nurses wear suitable shoes, owing to their enormous degree of fatigue—and this means no dressy street shoes.

23. Holes in gloves and towels or sheets constitute a break in the maintenance of asepsis.

24. Tapes and buttons must be used to keep gowns snug and in good repair.

25. When a glove is punctured, it should be discarded, the hands disinfected, and new gloves put on.

26. Wet gloves are cheaper. Dry sterilization ruins

rubber. Surgeons are expensive. Wet gloves ruin their temper.

27. Certain drugs must not be heated, others only for a limited number of minutes, to sterilize. The pharmacist must issue a code regarding cocain, novocain, adrenalin.

28. A bottle of aristol may be wound (with arm) in a bichlorid towel, after the top is wiped off, to be shaken over a line of sutures (by permission of the surgeon).

29. A general concerted effort toward simplification of methods brings success. An operating room cannot succeed if weighted down with the idiosyncrasies of several surgeons.

30. One surgeon alone on a staff is entitled to idiosyncrasies only by the unanimous vote of the whole staff.

CHAPTER X

FORMULÆ AND DIRECTIONS

"Formula and Preparation of Dakin's Solution (American Medical Journal, 1916).

"To the Editor: The formula for the preparation of Dakin's solution, which you give in the Journal, October 7, 1916, has recently been superseded by the following, which I obtained from Dr. Carrel at Compiègne last May. The unsatisfactory results sometimes obtained by the original preparation, and the disfavor which it has acquired in the hands of some surgeons, are probably due to imperfections in the product, such as the persistence of alkalinity. Some of the wounds which I saw in various hospitals under the treatment were brown and unnatural in appearance, while all at Compiègne were rosy and apparently entirely free of pus. The wounds were there kept constantly wet with the solution, which was introduced through tubes and poured on the surface every two hours. It is desirable that the determination of its value should not be delayed by defects of preparation, and you may therefore think it worth while to publish this formula (Lewis A. Stimson, M. D., New York).

"Preparation of Hypochlorite Solution (Dakin):

1. Chlorinated lime (bleaching powder), 200 gm.
   Sodium carbonate, dry, 100 "
   Sodium bicarbonate, 80 "

2. Put the chlorinated lime in a 12-liter flask, with 5 liters of ordinary water, and let it stand over night.

3. Dissolve the sodium carbonate and bicarbonate in 5 liters of cold water.

4. Pour (3) into the flask containing (2), shake it vigorously for a minute, and let it stand to permit the calcium carbonate to settle.

5. After half an hour siphon off the clear liquid and filter it through paper to obtain a perfectly limpid product. This must be kept protected from the light.

"The antiseptic solution is then ready for surgical use; it contains about 0.5 per cent. of sodium hypochlorite with small amounts of neutral soda salts; it is practically isotonic with blood-serum. It should meet the following tests:

"*Test.*—Put about 20 c.c. of the solution in a glass, and pour on its surface a few centigrams of phenolphthalein *in powder;* shake it with a circular movement as in rinsing; the liquid should remain colorless. A more or less marked red discoloration indicates the presence of a notable quantity of free alkali, or incomplete carbonation, imputable to an error in technic.

"*Errors to be Avoided.*—Never heat the solution. If in an emergency it is necessary to triturate the chlorinated lime in a mortar, do so only with water, never with the solution of the soda salts.

"*Trituration.*—To 10 c.c. of the solution add 10 c.c. of distilled water, 2 gm. of potassium iodid, and 2 c.c. of acetic acid. Pour into this mixture a decinormal (2.48 per cent.) solution of sodium thiosulphate (hyposulphite) until it is decolorized. The number of cubic centimeters of thiosulphate employed multiplied by 0.03725 equals the percentage of sodium hypochlorite in the solution."

Thiersch's Solution.—A valuable antiseptic for nose and throat.

Salicylic acid,	2 parts
Boracic acid crystals,	12 "
Water,	1000 "

Used by some surgeons during operations and as a dressing solution.

Formulæ for Iodoform Packing:

I. New York Post-Graduate Hospital—stainless, fadeless.

Iodoform powder	℥xxj
Glycerin	℥xxj
Alcohol	q. s. ad. Oiv

Sterilize. Keep in clear glass jars lined with waxed paper, which may be sterilized like gauze.

II. New York Eye and Ear Infirmary:

Iodoform powder	15 c.c.
Normal saline	120 "
Carbolic acid solution (5 per cent.)	℥j
Tincture green soap	℥ss
Glycerin	℥ss

Sterilize in open jars for twenty minutes at 15 pounds, lids beside jars and inverted, in the dressing sterilizer.

III. Iodoform powder..... ℥ij
Tincture green soap..... ℥iij
Water distilled..... ℥vj
Soak gauze in solution, wring dry, sterilize in open jars for thirty minutes at 15 pounds.

IV. Iodoform powder..... ℥iij
Ether..... Oiij
Stir well. Soak, wring dry, then scrub up and proceed as in Formula V.

V. Ten per cent. iodoform gauze. Sterile cotton plugs, or sterile rubber caps for tubes.
Iodoform powder..... 1 part
Sterile glycerin..... 4 parts
Alcohol, 95 per cent..... 5 "
1 in 10 = 10 per cent.

Also gauze packing or bandages, with sizing thoroughly washed out, before using.

2 Round basins,

1 Sound for packing tubes,

1 Pair scissors.

Marble or glass slab—sterile towels.

Nurse scrubs up and places above named sterile articles on sterile table.

Fill one basin with bichlorid of mercury 1 : 5000.

Wring gauze out of bichlorid, and pass it into the other basin, containing iodoform mixture, rubbing it in well, and equally throughout. Sterilize.

VI. Iodoform powder..... ℥j
Water (distilled)..... ℥ij
Tincture green soap..... ℥iij
Gauze..... 12 yards
Mix well, rub thoroughly into gauze; sterilize thirty minutes at 15 pounds, or 250° F. Keep in tubes or jars.

VII. Iodoform powder..... ℥v
Glycerin..... ℥j
Bichlorid of mercury solution (1 : 1000).... ℥v
Sterilize in test-tubes with cotton plugs and muslin cover for twenty minutes at 15 pounds.

Gauze for packing should be fine, smooth, and perfect. It should be previously drawn, raveled or folded, in odd

half-hours in the anesthetic room, while waiting, etc. It must be clean. Bandages are raveled at the ends, to leave smooth, threadless borders, because loose threads left at time of removal act as a foreign body in a granulating area. The fuzz must be snipped off so that the remaining part will exactly measure $\frac{1}{2}$, 1, or 2 inches, when spread out single, as labeled. Plain gauze packing is sterilized once more, in muslin covers, or in open jars, in 12-inch to 5-yard strips for ear, uterus, rectum, osteomyelitis, carcinoma of cervix, etc.

The drugs of the formula are mixed with a sterile spatula in a sterile glass graduate or bowl, using a sterile minim glass to measure small amounts. Pour into a flat glass basin, also boiled. Emulsify powder thoroughly in the green soap and glycerin before adding the aqueous solutions. No stain is left on glass utensils, hence they are an advantage.

Catgut.[1]—I. Wash tubes with soap and water—rinse—soak in bichlorid of mercury 1 : 2000 for two hours—put in sterile glass jars and cover with bichlorid solution.

II. Boil tubes of catgut and let stand in Harrington's solution, with a gauze compress to cover them, under the lid of the jar.

Much blame for infection is laid on the catgut, where it may be justly placed on the technic in preparation for the operation. Catgut should be made from the intestines of range lambs which are least susceptible to tetanus or anthrax.

Surgeons' Silk.—This should be threaded in 15-inch lengths, in all grades of strength, on all needles suitable for wounds requiring silk, and then run through a hemmed square of white flannel, afterward dry sterilized, but not too often (dry method rots silk, more than boiling). This saves the trouble of threading during an operation.

Silkworm-gut.—Must not be handed for a lip or other delicate surface.

Bone Wax.—Boil wax in its container, with cover

[1] See Dr. Brickner's comprehensive work, The Surgical Assistant.

separate, for twenty minutes, then cool, cover, and wrap in a sterile towel to be carried about. When it is the hobby of one surgeon, it is carried by him to the various hospitals where he operates.

Vaselin.—Prepare similarly.

Aluminum Acetate Solution:

Plumbi acetate	3.5
Alumen	9.0
Aqua	ad. 100.0

Mix and filter.

Dilute when using with five to eight times as much water.

Never use it full strength, as it macerates the skin. The ingredients are very costly, and the amount must be carefully estimated. For a small spot to be kept wet with a small gauze dressing, *e. g.*, a redness, the size of a half dollar on a leg, about a half pint is enough to make up at once of 1 : 8 aluminum acetate. Use a sterile basin, and sterile water, with aseptic precautions. If about one-half pint, say ℥ix, be needed, of 1 : 8 solution, then ℥j only of aluminum acetate is taken, and sterile water added, ℥viij (one **to** eight = one **in** nine). This keeps down the patient's drug bill. Moisten the gauze, lay it loosely on the spot, then lay the limb on a towel and rubber sheet, then cover with a high cradle to let air circulate and evaporation take place, causing reduction of temperature. Do not envelop limb in rubber.

Boric Acid Solution:

Boric acid (crystals preferably)	4 parts
Water	100 "

Boil till clear. To use, add an equal amount of sterile water (2 per cent.).

Pharmacists employ the cold process by adding the powder to cold water and letting it stand and absorb until a sediment of boric acid lies at the bottom (supersaturated).

Normal Saline.—Salt exists in the blood in the propor-

tion of 9 parts to 1000, or 9/10 per cent. It is not necessary to say to an intelligent person 9/10 of 1 per cent., it is to be hoped. Saline solution is called normal when it contains as much salt as blood does.

Uses of normal saline:

Douches of eye, nose, mouth, throat, rectum, perineum,
Hypodermoclysis,
Hypodermic with local anesthetics,
Intravenous infusion, etc.

A patient should get normal saline to take the place of blood lost in hemorrhage to tide him over, till, with the ingestion of food, he soon makes more new blood. Saline is a stimulant after shock.

How to make normal saline.

I. One quart of blood or normal saline = 32 ounces = 256 drams = 15,360 grains. 9/10 per cent. (determined by pathologists) of one quart = amount of solid salt. 9/10 of 1/100 of 15,360 grains = 138 grains. (Salt in one quart blood or saline.)

In every quart of water place 138 grains prepared salt, and boil thoroughly for five minutes, skim, measure, and add enough sterile water to restore to the proper number of quarts, some having evaporated. Cool. Filter through sterile cotton and sterile filter-paper, coarse, then fine, regularly plaited to fit into a sterile funnel, into a set of Florence flasks of 1 pint, 1 quart, or 2 quart sizes. Florence flasks are cleansed by bottle brush, tincture of green soap, sterile water, rinsing, alcohol and final rinsings, then stoppered with sterile cotton plugs till needed.

II. Salt may be prepared in tablets of the required weight, and these are dissolved in distilled water. Every hospital may have a distillation outfit for use of the operating-room and the pharmacy. It may be tucked into the sterilizing room. Distilled water should be collected daily and used at once. If kept under aseptic conditions, it will minimize bacterial activity in the solution.

I AND II

To transfer saline solution to the flasks, the nurse should "set up" a sterile table with sterilized cotton, towels, gauze, tapes to tie, utensils and hands scrubbed as for operating. The round body only of the flask is filled, then all are set on the floor of the dressing sterilizers for one-half hour at 15 pounds, on three successive days, care being taken to tag them as they come out, as being done by such a nurse, and once, twice, thrice. If at any time a cloudy growth or crystals are seen in the flasks, do not use the solution. The brilliant clarity of well-made saline is a mark of distinction in a good operating room.

Bichlorid of Mercury Solutions.—Here is where a teacher of arithmetic shines in a training-school. It is not enough to ornament the walls of lavatories with printed instructions. At the end of the probation period, every nurse should be able to teach all other nurses for all time to come, **why** $7\frac{1}{2}$ grains to a pint makes a 1 : 1000 solution. Pathologists have found that *many pathogenic bacteria die* (not all) in solutions of many of the common drugs used for germicides, of the strength of 1 part of the drug to 1000 parts of water. In estimating we want common measures, such as *pints*, or *thousands* of units.

One pint = 16 ounces = 128 drams = 7680 grains.

A germicidal solution of 1000 parts has 1 part of the drug.

A germicidal solution of 1 part has 1/1000 part of the drug.

A germicidal solution of 7680 parts or grains will therefore have $\frac{7680}{1000}$ or $7\frac{1}{2}$ (almost exactly) parts or grains of the drug.

Therefore, $7\frac{1}{2}$ grains of *any drug* dissolved in 1 pint of water makes a 1 : 1000 solution of that drug.

* * * * * *

A man against 1000 foes has not much chance. Against 2000 foes he is only **half as strong.** A solution called 1 : 2000 is **only half as strong** as 1 : 1000, because the 1 is the man (or drug) and the 1000 or 2000 is the foe (or

water). To make a 1 : 2000 solution we add twice as much water, 2 pints, to $7\frac{1}{2}$ grains (unchanging amount) of the drug.

Never Break a Tablet.—The actual dose may be all in one end and only milk-sugar in the other. Dissolve it entirely in an exact measure of water and take half the liquid, if required.

1 : 500 is stronger than 1 : 1000. A man has *twice as good* a chance with only 500 foes as with 1000. If $7\frac{1}{2}$ grains in 1 pint make a 1 : 1000 solution, then we double the dose of bichlorid and keep the amount of water unchanged to make twice as strong a solution. Note that 1 : 500 cauterizes. It is used to brush lightly under the lids in trachoma. It will stiffen the hands, maceration following, being an escharotic.

Bichlorid of mercury deteriorates very fast, therefore should be used only in small quantities. Where required weak, it is very economical to keep a stock bottle of 1 : 1000 solution, made up daily. Stronger stock solutions are dangerous, being often measured too hastily.

How to compute for a douche.

Total amount needed for vaginal irrigation, 4 quarts.

Strength 1 : 6000 ordered.

One to six thousand solution is **five times weaker than = six times as weak as** 1 : 1000 solution.

One ounce of 1 : 1000 plus 5 ounces of water = 6 ounces of 1 : 6000.

One-sixth of 4 quarts or 128 ounces = $21\frac{1}{3}$ ounces.

$128 - 21\frac{1}{3} = 106\frac{2}{3}$ ounces.

Take $21\frac{1}{3}$ ounces of 1 : 1000 solution and the balance of sterile water or 1 pint, $5\frac{1}{3}$ ounces drug solution to three quarts, $10\frac{2}{3}$ ounces sterile water.

Another name, corrosive sublimate.

In some institutions a saturated solution is made 1 : 16, from powder, and from this, as the nurses work, they make their solutions by taking 2 drams for every pint of 1 : 1000 solution needed.

1/16 of ℥ij = 1/16 of 120 grains = $7\frac{1}{2}$ grains (as above).

Whenever a nurse makes up a solution, she should present the arithmetical explanation on paper to the supervisor for endorsement.

Colors.—Hospitals should all have standard colors for certain solutions to act as a check on absent-mindedness. To have a uniformity in this everywhere would assist nurses, who usually remain only about two years in one institution.

Tables:

A. *Troy weight:* 24 gr. = 1 dwt.
20 dwt. = 1 oz.
12 oz. = 1 lb. = 5760 gr.

B. *Avoirdupois weight:* 16 drams = 1 oz.
16 oz. = 1 lb.
25 lbs. = 1 quarter
4 quarters = 1 hundredweight (cwt.)
20 cwt. = 1 ton.

C. *Apothecaries' weight:* 20 gr. = 1 scruple
3 scruples = 1 dram
8 drams = 1 oz.
12 oz. = 1 lb. = 5760 gr.

D. *Apothecaries' measure:* 60 minims = 1 fluidram
8 drams = 1 fluidounce
16 oz. = 1 pint—symbol O (octarius)
2 pts. = 1 quart
4 qts. = 1 gallon—symbol C (congius)

Symbols:
Degrees, °. Minutes, ′. Seconds, ″.
Abbreviations:
i. e. = that is,
viz. = namely,
e. g. = for instance,
ibid. = the same,
etc. = and so forth.

Formaldehyd.—This is a gaseous substance, valuable as a disinfectant, to fumigate a room after contagion, by generating in large quantities with a force pump at the keyhole, or with candles inside the room, or in small quantities in a cabinet of bougies or cystoscopes which cannot be disinfected in any other way.

It is soluble in water in the proportion of formaldehyd 40 parts to water 100 parts.

This solution is called formalin. Other fluids are sold, such as formacal, having the same ingredients practically, yet not daring to use the original trade name which has commercial rights.

Formalin is measured just like lysol, milk, or carbolic acid. When we say formalin we consider it an original substance. Forget about how it is derived. Formalin solution 4 per cent. means 4 parts (oz. or drams) out of the formalin bottle to 100 parts (oz. or drams) of water.

Formalin 4 per cent. is particularly suited to the preservation of specimens, particularly the EYE. The laboratories ask for formalin. It does not shrink or harden delicate tissues. Alcohol ruins an eye specimen. Yet formalin hardens satisfactorily for section cutting. Specimens must be placed in wide-mouthed bottles with good new corks, to prevent evaporation and concentration of the drug, with consequent destruction of the tissue. Use it sparingly. It is hard on the eyes and the skin of working nurses, also expensive.

Nitrate of Silver.—This is best handled in tablets. They deliquesce when exposed to air, and deteriorate in light, therefore are best kept in a dark blue or brown bottle tightly stoppered with cotton and glass. The printed directions must be read very, very carefully. There is a tremendous difference in strength between gr. v, and gr. .5. Grains v is a tablet ten times as strong as gr. .5 ($\frac{1}{2}$). A bladder irrigation, based on this mistake, causes pain and tenesmus, by reason of its caustic effect on the mucous membrane. In handling dangerous drugs one should consult with a supervisor.

Percentage Solutions:

In both Troy and Apothecaries' Weight, 480 gr. = 1 ounce.

In Apothecaries' Measure, 480 minims = 1 fluidounce.

We say, frequently, $4\frac{4}{5}$ gr. to the ounce (roughly, 5 gr.) make a 1 per cent. solution.

Why is this?

One ounce of a drug is 100 per cent. pure.

If one oz. 100 per cent. pure = 480 grains (dry) or minims (fluid measure); then 1 per cent. pure = 1/100 of 480 = $4\frac{4}{5}$ gr. (dry) or minims (fluid).

The discrepancy of saying 5 gr. to the ounce is not so small as to be negligible, as pharmacists must calculate $4\frac{4}{5}$.

Then, 2 per cent. solution = 10 gr. or minims of drug to 1 oz. water; 10 per cent. solution = 100 gr. or minims drug to 1 oz. water.

Eye solutions of homatropin, argyrol, etc., are almost all estimated in percentages or grains to the ounce, because they are very powerful as well as expensive. Nurses should not dispense, as they usually are notoriously poor in arithmetic, like nearly all other women. It shakes the confidence of physicians and patients to see a nurse handling powders, etc., in a drug room.

Ringer's Stock Salt Solution:

Sod. chlor.	150 oz. Troy
Calc. chlor.	244.5 gr. Troy
Potass. chlor.	159 gr. Troy
Aqua destillata	q. s. ad. 5 gals.

Use 4 fluidounces of this stock and 28 ounces distilled water. Filter through filter-paper into Florence flasks. Plug with absorbent cotton and gauze. Boil twenty minutes.

Harrington's Solution:

Alcohol, 95 per cent	1600 c.c.
Hydrochloric acid	150 "
Aqua destillata	750 "
Corrosive sublimate	2 gm.

Color with gentian violet (if this fits in with hospital scheme for drug colors).

Bismuth Gauze Drains:

This stimulates granulations and old sinuses.

Bismuth subnitrate	℥ij
Glycerin	℥ij
Warm water	Oij

Mix thoroughly adding, warm water gradually. Stir continually to make a fine emulsion. Pass gauze through it three times, then wring out, dry, cut in strips, pack loosely, with aseptic precautions, and sterilize at 7 or 8 pounds' pressure for thirty minutes.

Rubber Goods.—A. *Tubing.*—T-tube, used in vaginal punctures, a T made of two pieces of rubber tubing cut in a special manner. The cross-piece does not act as a drain. It merely holds the tube in position, therefore the end of the stem must be open. Do not boil with instruments. Do not let lie in the same cabinet with silver.

Provide safety-pins for keeping straight tubes from disappearing into the wound.

Tubing is bought in small quantities, owing to its perishability (three months). It is needed in different lengths, lumen, and firmness, as well as thickness of wall. It must be of first-class quality and odorless. Second-grade rubber, made from old galoshes and automobile shoes, smells bad. Keep in lycopodium powder in a cool cellar. When boiling, wrap it in old muslin to keep off the scum of the water. Boil for ten minutes and transfer to a clean boiled jar of 5 per cent. carbolic acid. It is used for gall-bladder, empyema, intestinal obstruction, and ruptured appendix operations. Statistics for the past three months on amounts used serve as a guide in buying. The cloth foundation must never show through.

B. *Rubber-dam.*—Thin sheets of pure Para rubber, non-irritant, are needed in cases such as empyema, where it is difficult to maintain tubes in position, or open wounds high up in the intestinal tract.

C. *Rubber Spools.*—Much used for empyema, propped against the bony structures inside.

D. *Rubber Tissue.*—(Gutta-percha.)

To *cleanse* and *sterilize*: Lay on a cold glass slab, scrub with small boiled brush, with tincture of green soap and cold water on each side. Rinse thoroughly under faucet. Soak over night in bichlorid of mercury 1 : 500. Second day: Lift with sterile forceps or scrubbed hands into basin of sterile water, fold in dry sterile towels till dry. Sterilize in dressing sterilizer for twenty minutes at 15 pounds, with gauze sheets between the layers of tissue.

This is used mostly for

(1) Cigarette drains,
(2) Like rubber-dam, over plastic work such as grafts,
(3) Over burned areas.

It does not stand frequent sterilization or age. The supply must be dated, and never allowed to become friable, as it is called for at critical junctures. It is never pinned, merely closed in folds. Mucilaged labels are inexpensive and business-like. Flour-paste labels are made by dissolving 1 teaspoonful of flour in 1 cup of cold water and boiling till clear.

Some hospitals keep rubber tissue in sterile glass jars lined with sterile waxed paper which can be heated with the rubber in the sterilizers.

Other institutions keep it wet in bichlorid of mercury 1 : 1000.

E. *Rubber Gloves.*—1. In *buying gloves* the operating-room supervisor's statistics, if correct, are very valuable. The *glove* must be regarded as one of the institution's "long arms of efficiency." It is the most fertile source of anger and jealousy. Those concerned should sit down together and frame a policy on gloves, in an unimpassioned hour, and abide by it, as follows:

(1) Who may have gloves at all?
(2) Who may always have new gloves?
(3) Who will buy the gloves?
(4) Shall the gloves be boiled and put on wet or dry—sterilized?
(5) Shall the obstetricians receive the same consideration as surgeons?
(6) Who shall clean and repair gloves owned and brought by the surgeons?

If all hospital administration were based on the welfare of the *patient*, snags could be easily avoided. Favoritism frequently occurs. A young man, not yet famous, is put off with old gloves with holes, or loosely flabby, or overmended, when he has to palpate an on-coming head in a

delivery, whereas a prosperous older man is given brand new lively gloves for a carcinoma case. Standing on the merits of the cases, the new clean baby is a bigger asset to the community than the wrecked life of the old carcinoma case.

II. *Records* must be kept of the sizes, idiosyncrasies, and "wet" or "dry" of all operators, including visiting surgeons. It is the beginning of success to win a smile from a great surgeon by handing him the correct gloves, if he has been there once before, or if the size has to be telephoned for. Interns must find their size when coming on the service and record it. Scrubbing nurses (on sutures) must be satisfied with mended gloves (unless in bone-plating, etc.) because they merely pass goods.

III. *Responsibility* for proper arrangement in packages is taken by the nurse who puts up gloves for clinics, by signing a slip which goes with them.

IV. *Arrangement.*—When a surgeon operates, the drum contains gloves for him, his two assistants and, the suture nurse. In case he spoils a pair, they may be replaced by separate packages outside the drum in reserve, of the correct size.

V. *To Put Up.*—(*a*) Gloves are carried after the operation in a basin to the hoppers. Wash in cold water to remove blood, K. Y., vaselin, or pus. Squeeze out the air, wrap in old muslin, and boil five minutes. Lift out, test with cold water for holes, classify as good and bad, and hang on the glove-tree. Turn and dry both sides. Send to the workroom in two lots.

(*b*) The *glove mender* blows up the glove, locates the hole, wets it slightly in a doubtful place to see if bubbles form (Fig. 21). To blow up a glove, twirl it by the wrist stretched taut with forefingers, catching the wrist tight, and forcing the air up into the digits. To mend—roughen the edges of the hole with sandpaper or a nail file. Cut the patch oval shaped. Clean the two areas with benzine. (Special permit from fire department to keep on the premises.)

Apply Pure Gold or other rubber cement to the glove, press the patch on, keep it there with warm hand pressure, then lay under a press. Powdery gloves will not mend.

Fig. 21.—Detecting holes in a glove.

If any part overdilates, mark it *poor*. Do up a package of powder with gloves.

(*c*) *To Powder Gloves.*—Shake a quantity of unperfumed talc powder into a gallon basin. Set it on the

work table. Sit on a very high stool, and get plenty of purchase to press downward. Pass gloves through powder twice (turned) squeezing them down into the unyielding basin. Fold back the cuffs till they are only wrist length (short), so that the scrubbed hand of the surgeon may take the glove by its *inside*. (See chapter on Asepsis.) Put up in covers, and sterilize in drums for fifteen minutes at 10 pounds, or whatever the hospital formula specifies.

F. *Rubber Aprons, etc.*—Aprons are soaked in bichlorid of mercury 1 : 1000 before operation. After operation they are scrubbed with cold water, tincture of green soap and brush, rinsed well, painted with 5 per cent. carbolic acid solution, dried over a bar, and powdered with lycopodium. All flat rubber should be kept rolled on a Hartshorne roller under the edge of a counter or shelf.

Douche bags (seldom found now in hospitals) are boiled, rinsed, and left to hang inverted. Oil for enemata must be administered per funnel, not bag.

G. *Hard Black Rubber.*—This must be kept in cotton-lined boxes in order not to chip or break. If roughened the least bit, it will injure the part. It is cleansed with cold water, soap, bottle or tube brushes of proper caliber, and 5 per cent. carbolic acid. *Black hard rubber must not be boiled.* It may be disinfected in a fumigating cabinet. Heat alters the shape of a pessary or tracheotomy tube, and this may hold up that most urgent of all operations.

H. *Rubber Catheters.*—(1) *Plain.* These should be kept in a very long flat box in a cool place in lycopodium powder. This box has compartments for the many kinds of catheters, to show at a glance when one stock is low. The box is locked and the key kept with the general operating-room keys. These things may not be wanted often, but very badly at times. No one should have access to this but the nurse on that branch of the service. She makes the record of the *patient, doctor,* and *ward* on her spindle

or wall-file till it is returned. If not in good condition, she reports to the hospital buyer, who charges it against the ward—"Retention catheter, No. 14 (mushroom), Ward B, Mrs. Amelie Mintz, Signed, Mary Jones, Ward B, charge nurse."

These catheters are washed in soap and cold water with care to remove the usual lubricant, then held under the cold faucet and *milked*, like a cow's udder, to remove any solid particles, then boiled in old muslin, and hung to drain in a cool place.

1. Stretch to see if resilient.
2. Discard rough or cut, slashed catheters.
3. Male catheters should not be kept in the same box as those for women.
4. Orderlies may be sometimes entrusted with stock for the wards, but must not be allowed to come to the nurses in the operating room (if necessary, send ward nurse).
5. To avoid many embarrassments, one great hospital supply firm makes female catheters only 8 inches long—it does not touch an unscrubbed part, nor twist and drop.
6. All catheters should have funnel-shaped distal ends.

(2) *Mushroom and T-Retention.*—These are retained in the bladder, and are inserted above, in the course of the operation, or at its conclusion, while the patient is yet relaxed, by means of an olive-pointed bougie or a large uterine probe. No force is employed, but a vast amount of lubricant. Very, very slender uterine dressing forceps may be used, but it is risky, on account of the numerous folds of mucous membrane in the urethra, and only when the patient is fully under the anesthetic.

Filiforms.—These are kept in a cool place in a very long box, in lycopodium powder. Some are fine as horse-hair, some are olive tipped. They are used for delicate genito-urinary work, such as determining the patency of the male urethra in cases of stricture (diagnostic, like a engtth being added to the surgeon's finger) and also the latency of the fallopian tubes in cases of relative steriltiy

(caused by scarlet fever, etc.). They are washed in cold water and dilute tincture of green soap, then dried, and hung in the formaldehyd cabinet.

Bougies.—After a stricture has been located, a passage may be created with mild pressure by a bougie, which is a solid, stiff catheter made of waxed silk or catgut, chemically treated to be firm. They are cleaned and disinfected as above. Mice must not be allowed to eat the shellac on bougies (thereby roughening the surface).

Silk Catheters (Elastic Web).—These must not be bent or boiled. They are of woven silk, covered with shellac, and must be kept cool at all times. They are harmful to the delicate urethral canal, if roughened the slightest bit, by causing an abrasion, then a stricture. They must be washed in cold water and Castile or Ivory soap. All white soap ends should be boiled down into a jelly for these uses. Drain, then dry, and hang in the fumigating cabinet.

Fumigating Cabinet.—The hospital carpenter can improvise such a cabinet, covering its seams with "gum tite." It can be carried with its door to a window to let off the fumes of the candles of formaldehyd last used. Fine cabinets of iron and glass are made for this by the hospital supply companies.

Preservation of Specimens.—When a surgeon cuts a section out of a doubtful breast, gut, or cervix, to be "frozen" and examined immediately, before proceeding with the operation under one continuous anesthetic (amputation) a long journey to a distant laboratory is out of the question. Everything must be planned beforehand to be ready in the workroom:

(1) Microscope placed advantageously as to light, on a solid table.
(2) Stool.
(3) A watery solution of formalin, 5 per cent., three to five minutes' immersion.
(4) Alcohol, 50 per cent., three minutes' immersion.
(5) Absolute alcohol, one minute.
(6) Wash off with water, stain, etc.

This is a speedy "combination freezing and fixation" method by Dr. Thomas Cullen of the Johns Hopkins Hospital. It is the nurse's duty to provide the stock materials and utensils, graduates of various sizes marked by the metric system, and to clear a place wide and light enough for the pathologist to work.

Care of Glassware.—There are never enough connecting tubes. Glass catheters, medicine droppers, etc., are washed in soap and water, rinsed, boiled ten minutes and kept in bichlorid of mercury 1 : 1000, or formalin 2 per cent., or boric acid 4 per cent. The rubber tops of medicine droppers are a trap. They may contain pure lysol that could be squirted next into a baby's eyes. They must be perfectly washed.

Soda Bicarbonate Solution.—This is given in the operating room or with aseptic precautions at the bedside in cases of acidosis and diabetic coma, in two ways:

Subcutaneously,

Intravenously.

A 3 per cent. solution (30 gm. in 1000 c.c.) is made, filtered, and boiled five minutes to sterilize, in a Florence flask stoppered with gauze and cotton. Solutions for immediate intravenous use need be boiled only once.

Glucose Solution.—This is made from solid grape sugar. It is used in rectal feedings in strength from 5 to 10 per cent. In subcutaneous and intravenous injection it is given in 5 per cent. solution only. Dissolve 50 gm. glucose in 1000 c.c. boiling distilled water. Filter and boil in a Florence flask five minutes. Stopper as above.

Silver Leaf.—This is bought in books of paper leaves, interleaved with these delicate gossamer sheets (Fig. 22). Cut the book into sections of 5 sheets each. Protect each booklet by 2 sheets of heavy cardboard, wrapping it in a double muslin cover (pinned, point buried in muslin) and label. Sterilize one booklet only for twenty minutes at 15 pounds. Do not sterilize the remainder till about to be needed. They become too friable. Silver leaf is made with a hammer, beating out the actual metal into

an incredible thinness lighter than air. To keep unsterile goods in reserve saves money. A large sterilized bulk runs no danger of being infected. It is used over area denuded in skin-grafting.

General Rule About Sterilizing.—All clean articles (such as silver leaf, never exposed to germs) which *cannot be boiled and are not used again* are sterilized at 15 pounds for twenty minutes.

How to Prepare Sterile Adhesive.—Cut the strips the desired length and width. Roll on a wide-mouthed bottle in single thicknesses (gallon bottle). Sterilize in the

Fig. 22.—Silver foil.

dressing sterilizer in a double muslin cover. When needed, the bottle is set on the suture table and filled with hot sterile water, tempered at first with cool.

Hooks and eyes as substitute for skin sutures. A certain successful surgeon uses adhesive edged with hooks and eyes to avoid the stitch abscess and yet obtain a fine line of union.

Sew the hooks and eyes on two strips of white 1-inch tape at the exact proper distances, for a length of 8, 10, or 12 inches, to be slightly longer than the characteristic incision made by the surgeon. Cut sheets of adhesive the same length and 6 inches wide. Leave the crinoline

on the adhesive except on the edge at the median line, where it is removed for the width of 1 inch. Plaster the tape down here, with the hooks and eyes on, slightly turning in the edge of the adhesive. Face the bare inch surfaces with adhesive, its edge also turned in a little. Overcast the edge down among the hooks and eyes. Then remove the crinoline, and plaster the two sheets side by side on a large (gallon) bottle. Put up in a double muslin cover, sterilize, and remove as above.

Diachylon Plaster.—This has been used eighty years. It is made with a lead base. Heat it over an alcohol flame before applying, but do not burn the patient. The nurse should test it to her cheek. Used in orthopedic work.

Syringes.—Nothing is more neglected than syringes (of all kinds). Nothing is more badly needed at the time, and the cost of goods destroyed is scandalously large. Syringes must be taken apart, and washed in cold water after oils, human or animal blood or serum, etc., with fine bristle brushes (such as for drinking tubes), then boiled separately, cooled, wet again, and put together. Care must be taken never to wet the wick at the head of the plunger with the drug or serum.

Care of Tracheotomy Tubes in Situ.—This is begun before the patient comes off the table. The tube is best cleaned by pheasants' feathers, which are flexible and pointed though firm. They should always be on hand.

The whole apparatus is covered with gauze moistened in soda bicarbonate solution, because the mouth and throat secretions are usually acid. Inner tube must be in.

Care of Instruments:

I. *The Cabinets.—Calcium chlorid* on a saucer in the cabinets minimizes the humidity, for which there is a scale or dial with hand or indicator in the back wall. When it deliquesces, new dry lumps should be substituted.

Camphor placed similarly here and there preserves the luster of the instruments by preventing oxygenation. No rubber in cabinets.

Instruments should be put away boiled free of all germs from **last patients,** though the cabinet is not "sterile," and arranged according to:

(1) Surgeon owner,
(2) Rooms where used,
(3) Operations required for,
(4) Age, condition, size, state of repair.

Knives should be in original boxes.

Sounds are rolled separately in flannel (no contact with each other) or slipped into the compartments of a bag such as used for flat silver in a residence. Contact causes roughnesses, which cause abrasions, which cause strictures.

Cabinets should stand in a corridor not in line with the sterilizing room, to avoid humidity. They should be inspected weekly, and inventoried at set dates.

* * * * * *

II. *Cleaning Instruments.*—A. After operations *account for all* needles, knives, clamps, etc., and *classify* in different basins. Take to hopper room. If one instrument is missing, *get it immediately*—even at the peril of reopening the patient or taking an *x*-ray of him.

B. Wash in cold water to remove blood or pus. Wear heavy gloves p. r. n.

C. Prepare instruments for boiling as follows:

1. Fasten the needles in thick gauze with two bites each, and cover.

2. Fold the knives and scissors into old muslin, each in a layer by itself.

3. Drop blunt instruments in, wrapped also in muslin.

4. If house rules require, sterilize edged tools with 95 per cent. carbolic acid and alcohol.

5. Add a handful of sodium carbonate (washing soda), if the boiler is not aluminum,

(*a*) To soften the water,
(*b*) To prevent rust,
(*c*) To raise the temperature, thus facilitate sterilization.

6. Do not let scum or crust become deposited on bare instruments.

7. Boil for ten minutes after clean, twenty minutes after septic cases.

D. Scouring. Carry from the hopper to the workroom after lifting out the tray. Drain, unwrap. Use a thick oak or pine knife board, $1\frac{1}{2}$ by 1 foot by 1 inch, with a headpiece to push against, a place for brushes and Bon Ami.

Rub with

Well-boiled flat wide corks,
Pieces of gauze,
Flannelette,
Small coarse tooth brushes (5 cents)

in order to get into the corrugations and crevices.

An electric emery burr, such as one finds in well-regulated homes to clean the chasing on silver, is priceless for uneven instruments. It may be run by the same motor as the sewing-machine, as all this is done in the workroom. Emery is a very fine abrasive and leaves no scratches.

E. Inspection. See if they need repair (new parts, sharpening, renickeling). If so, set aside at once. Do not let go into general circulation again. Drop into a wide flat basin with a lathery solution of tincture of green soap, then with hot water, then transfer to a basin of alcohol, there to wait to be all dried together. Set pan of dry instruments in a warm place. Keep a large stock of old soft, highly absorbent towels (preferably linen) for drying. A pint of alcohol may be used over and over for this purpose if filtered and then tightly corked and labeled for this use only. Oil the corrugations, locks and joints, as well as all screwed parts with Three-in-one before laying on the shelves. Needles are threaded with suitable silk and run in flannel.

Hollow needles of

Trocar,
Spinal puncture,

Syringes,
Aspirators

may be dried by standing vertical on a metal sheet over a mild flame or radiator, or lying with stilet in, on same. Otherwise they may be held in forceps very high over an alcohol flame (dry without smoking). Oil stilet before inserting (dry).

Never put away a needle or trocar without its stilet. Platinum needles are best. Always clean the stilet with abrasive and push it through needles loaded with best abrasive.

Ivory-handled Eye Knives.—These must not be boiled. Wash, dry, and sterilize in formalin or benzine, rinse, and wipe dry (after operation).

Any knife should be used only once, then sharpened. The delicate edge is not electronickel plated like the body of the blade. They should be washed and dried immediately after using, and laid in parallel rows, no two parts touching.

Hospital Cold Cream.—For the anesthetic room some cream is needed for patients who fear the use of vaselin, etc.:

White wax	℥iv
Spermaceti	℥iv
Liquid petroleum (white mineral oil)	℥xxxij
Sodii borate (borax)	℥ss
Rosewater	℥xvj

Melt the wax, spermaceti, and oil together at a very moderate heat. Dissolve the borax in the rosewater, then warm this solution and add it to the melted waxes and oil, and stir briskly until cool and creamy.

Hospital Hand Lotion:

Powdered tragacanth	℥j
Alcohol	℥ss

Mix together and quickly add 1 pint of water and stir briskly.

Add 1 ounce of glycerin and 2 ounces of alcohol and add water to make 1 quart.

Perfume to suit.

To Sterilize Vaselin.—Sterile vaselin is prepared by setting the container in a water-bath and putting a

dairy thermometer in the vaselin, raising it to 212° F., and keeping it at that point for an hour. The lid is boiled beside, but not on, the container. To obtain sterile vaselin from such a jar afterward dip in a sterile grooved director that has not been included on the instrument table. Do not put in the gloved finger. The grooved director may be then drawn over a sterile compress or applied to the glove. One can judge by the surface being intact that the vaselin is sterile. This should be done daily in cases of constant catheterization, etc.

CHAPTER XI

THE METRIC SYSTEM

This is discussed in an elementary manner because many girls lack the mathematical sense.

LINEAR MEASURE

The basis of the metric system is the unit of length. From it are worked out all other measures:

Square, or surface, second dimension,
Cubic of solids, or volume, third dimension,
Cubic, of liquids, or capacity,
Cubic, of weight, of dry solids.

Weight changes at different levels above the sea and in varying temperatures.

Capacity changes are due to density at certain times or other physical conditions.

In order to have an unvarying standard for distance, international and indisputable, the French, when changing their government and other systems, took as a unit that measure which is one ten-millionth of the distance between the Equator and the North Pole, and called it a meter, which means measure (39.37 inches).

In this one dimension, to get smaller units of length, always dividing by 10, they used Latin prefixes to denote diminution, and adopted this scheme uniformly through all their system of weights and measures. Whenever the prefixes

deci, 1/10,
centi, 1/100,
milli, 1/1000,

are used, the original quantity is diminished by so much, whether it be length, surface, volume, capacity, or weight.

For example:

meter = 39.37 inches (or one yard plus $3\frac{37}{100}$ inches).
deci-meter = 3.937 inches (or about $\frac{1}{4}$ foot).
centi-meter = .3937 inches (about 2/5 inch).
milli-meter = .03937 inch (about 1/25 inch).

In this linear dimension, to get larger units, multiplying by 10, Greek prefixes were adopted, to denote increased length.

For example:

meter = 39.37 inches.
deca-meter = 393.7 inches.
hecto-meter = 3937.0 inches.
kilo-meter = 39370.0 inches. (about $\frac{5}{8}$ mile).

The word kilometer became very familiar to American soldiers in France as the measure of distance on their marches.

Possible Problems in Linear Measure:

To rule a chart in columns each 3 decimeters wide:

1 decimeter = $3\frac{9}{10}$ inches (approx.).

3 decimeters = $\frac{39 \times 3}{10} = 11\frac{7}{10}$ inches (12 approx.).

The nurse should make actual drawings of these measurements, to be able to form a proportionate mental picture of any object described by the metric system.

SQUARE MEASURE (OF SURFACES)

Square measure is derived, too, from the meter as a unit of length, as we multiply length by length to get area. If a plot of ground is 5 meters long and 4 meters wide, it contains 5 × 4 meters = 20 square meters.

This does not occur frequently in the American nurse's work. However, a possible problem would be

To cut compresses 10 centimeters square, *i. e.*, 10 centimeters long and 10 centimeters wide.

If 1 centimeter = 2/5 inch (approx.)

then 10 centimeters = $\frac{10 \times 2}{5} = 4$ inches (approx.)—the compresses would be 4 inches to each side = 16 square inches.

CUBIC MEASURE

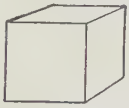
Cubic measure is used in wood, earth, sand, stone, concrete, etc., as well as in water, saline, glucose solution, soda solution, sterile water, etc., in the operating room. The basic unit here is a cubic centimeter, which is arranged by erecting a mass of any of the above substances, which is 1 centimeter long, 1 centimeter wide, and 1 centimeter thick (or high).

VOLUME

Nurses are concerned mostly about volumes of water and saline. Their problem is to grasp the ratio between American quarts and metric cubic centimeters. A c.c., or *cubic centimeter*, is a volume of water which has the following proportions:

length = 1 centimeter (about 2/5 inch).
width = 1 centimeter (about 2/5 inch).
thickness = 1 centimeter (about 2/5 inch).

appearing to the eye as follows:



and in American measurement contains $2/5 \times 2/5 \times 2/5 = 8/125$ cubic inch.

The cubic centimeter is the unit for measuring substances such as saline or sterile water.

A volume of water 10 centimeters long, 10 centimeters wide, 10 centimeters high, or 1000 cubic centimeters, equals our American quart (approx.) and is called a liter in France.

If 1 quart = 1000 c.c.,
then 1 pint = 500 c.c.

Memorize this, but remember its significance.

One pint fluid measure = 7680 minims.
One c.c. = 1/500 of 7680 = 15 minims (approx.) fluid measure.

Memorize.

WEIGHT

In order to have a unit of weight, the scientists then took as the base 1 c.c. of water again. But water varies as to

Mineral content,
Organic matter,
Density,
Temperature,
reacting on each other,

therefore they had to stipulate certain conditions about this basic unit:

It must be distilled water (uniform the world over), at 4° Centigrade (when water is heaviest or densest).

They called this unit one gram. It is the starting-point for all substances that are weighed, such as boracic acid crystals, bread, sugar, flour (in nephritic or other diets), salt, etc.

Again, the Latin prefixes denote diminution:

1 gram = 15 gr. Troy (dry weight).
deci-gram = 1.5 gr. Troy (1½ gr.) or one-tenth.
centi-gram = .15 gr. Troy (3/20 gr.) or one-one-hundredth.
milli-gram = .015 gr. Troy (3/200 gr.) or one-one-thousandth.

Once more, the Greek prefixes denote multiplication:

deca-gram = ten times one gram = 150 gr. Troy (5/16 oz.).
hecto-gram = hundred times one gram = 1500 gr. Troy (3⅛ oz.).
kilo-gram = thousand times one gram = 15,000 gr. Troy, about 2 lbs.

Kilogram is the unit by which meat, etc., is bought where the metric system prevails.

It is not absolutely true of all drugs at all times, but *approximately* speaking, in order to get a good mental picture, it is safe to say that minims (wet) = grains (dry), that is, the units in fluid and Troy are equal.

"A pint's a pound, the world around."
A liter (1000 c.c.) = 2 pints.
A kilogram (1000 gm.) = 2 pounds.

Many European countries and some institutions and professions here and there in America have adopted the metric system. It is especially suited to pathology, which has only recently attained its proper rank among the departments of medical science.

CENTIGRADE THERMOMETERS

It is necessary for every nurse to read the two kinds of Centigrade thermometers correctly (clinical and dairy) because they are employed frequently by certain institutions or professions or nations. She must at the close of her term in the operating room be able to explain these data to another nurse correctly, and with force to hammer it in.

The Fahrenheit thermometer was not consistently constructed. On it the freezing-point of water is named 32 degrees above zero.

On the contrary, it was the most intelligent thing in the world to consider the freezing-point of water as zero, dead, nothingness, etc., which the Centigrade does. Both were purely arbitrary man-made apparatus, not a natural growth. Again, for the same reason that zero is too far down on the Fahrenheit scale, boiling-point was put too far up. The space between was divided into too many degrees, too near together, with too little perceptible difference between neighboring ones. Boiling-point (at sea level) was called 212°. Those who travel or study physics know that water boils faster on a mountain top because there is less air pressing down on it. Hence we *standardize* by measuring temperatures at the sea-level, which is uniform throughout the world.

Centigrade thermometers designate boiling-point as 100°, to be consistent with the metric system (and their own name).

Note the following object lesson:

A. Dairy.

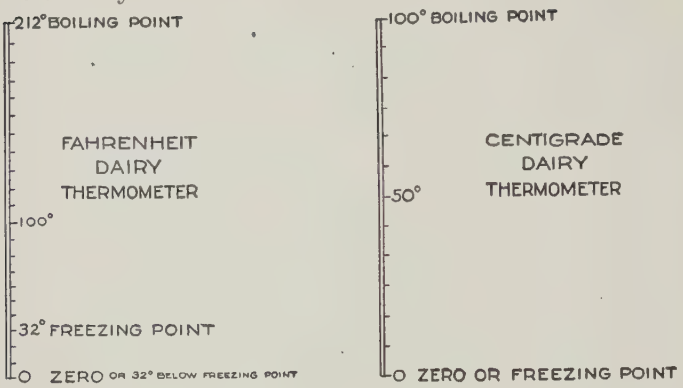


Fig. 23.

Nurse's Problem.—To heat a douche to 40° C., having only a Fahrenheit thermometer to test the solution.

The distance between boiling (212°) and freezing (32°) Fahrenheit is designated by 180° or divisions.

The distance between boiling (100°) and freezing (0°) Centigrade is designated by 100° or divisions.

$\therefore$ 100° C. = 180° F.
and 1° C. = $\frac{180}{100}$° F.
and 40° C. = 40 times $\frac{180}{100}$ = 72° F.

But this means 72° F. higher than freezing-point, or 72° above 32° = 104° F.

B. Clinical.

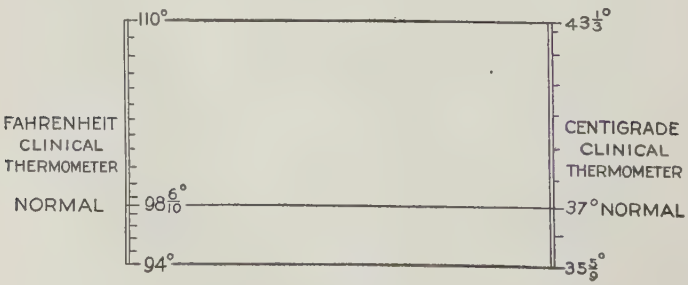


Fig. 24.

On the two clinical thermometers the scale registering body heat is only a small part of the total scale between boiling-point and freezing.

One must always take into account the loss between freezing-point and zero (32°) on the Fahrenheit scale.

A nurse would be quite startled to see that a patient was only 37°—till she had these two scales correlated.

94° F. = 62° above freezing	
180 divisions of the Fahrenheit scale	= 100 Centigrade
1	$= \frac{10}{18}$
62	$= 62 \times \frac{10}{18} = 35\frac{5}{9}°$
$98\frac{6}{10}°$ F. = $66\frac{6}{10}°$ above freezing.	
$\therefore 66\frac{6}{10}°$ F.	$= \frac{666}{10} \times \frac{10}{18} = 37°$
110° F. = 78° above freezing.	
$\therefore$ 78 divisions F.	$= 78 \times \frac{10}{18} = 43\frac{1}{3}°$.

The clinical centigrade thermometer is constructed to show whole exact degrees at the ends.

Lastly.—How frightened should a nurse be at rise of temperature indicated on a Centigrade thermometer in a patient, a sterilizer, or a solution? *Almost twice as scared* for one degree C. as for one old F. degree. On the new thermometer with its condensed scaling, one degree of rise is bad in the inverse ratio to that of the old. There are only 100/180 as many divisions, hence each fluctuation of a degree C. is 180/100, or nearly twice as bad.

Each nurse should draw these thermometers and demonstrate fluently before receiving her credentials for the service in the operating room.

CHAPTER XII

OPERATING-ROOM PHARMACOPŒIA

U. S. P.—The Government protects its people by a strict standard in procuring and dispensing of drugs. The details are clearly and fully laid down in a book called the United States Pharmacopœia (U. S. P.). New discoveries are made and thoroughly tested by severe critics before being admitted to the U. S. P. When a substance is listed there, it may be regarded as perfect for its purpose as therein described. Similarly, a drug listed elsewhere as B. P. means that it is satisfactory according to British standards. Climate, topography, humidity, exposure to air, light, heat, or cold (within buildings) all have effects on certain drugs. This must be learned and actively practised in order that the patient may receive 100 per cent. of benefit from the administration.

Preservation of Drugs.—1. *Volatility.*—Benzine, ether, ammonia, camphor, amyl nitrite, etc., must not be exposed to air. They deteriorate or disappear. Deterioration may mean simply

Losing force, or

Changing its chemical nature and becoming deadly.

2. *Exposure to Light.*—Adrenalin chlorid is an example. It should be kept in dark brown bottles, with a paper wrapping.

3. *Heat.*—Do not keep near a warm pipe, or a sunny window, or above a gas burner.

4. *Age.*—Argyrol should not be used after one to two (?) days.

5. *Moisture.*—Bromids, etc., deliquesce and cannot be measured.

6. *Exposure to Air.*—Iodin is dissolved in alcohol, which evaporates every time the cork is removed, becoming

more dense, *i. e.*, relatively stronger than the original tincture. Hence only very small bottles should be in regular daily use, or there will be burns. Collodion, being made with ether, becomes more dense by evaporation (may be corrected by adding ether). Iodin is put up by a foreign firm in small ampules covered with woven silk, to be broken as needed (excellent).

Safeguarding Poisons.—Of this there are many ways, but it is humanly impossible to guarantee: (1) That the brain of the worker will always be alert; (2) that it has no blind-spot; (3) that the field is always covered by a succession of suitable persons. None of the following methods are perfect:

A. Knuckles or hard-pointed prominences annealed on the outer surface of poison bottles.

B. Pin transfixing the cork, to prick the fingers of somnambulists.

C. Bell that jingles (also for somnambulists) at neck of the bottle.

D. Skull and cross-bones grinning hideously on the label (no good in dark).

E. Key to poison closet in responsible hands.

The best way and the only safe way is not to have any on hand. But that is out of the question. The quantity and range of poisons in the operating room may easily be very limited. They can be had on short notice from the pharmacist.

Safeguarding Valuable Drugs.—Alcohol is bought free of excise on a bond involving the personal honor of the Board of Directors. If a nurse stops to think of that, she should never use it for her own spirit-lamp, and she will prevent orderlies from taking it as a beverage. She is the stewardess for grave, responsible citizens who cannot be present, and do not doubt her willingness to mount guard for them.

Safeguarding Narcotics.—The responsibility for tabulating and doling out narcotics must be deputed by the resident officials to some nurse. A superintendent cannot

have an interview or conference interrupted by pupils converging on him from all wards after a surgeon makes rounds and orders morphin. If a nurse has not had uprightness and stamina at eight years of age, to be custodian of certain property, she will never have it. Hospitals never yet put honesty into anybody. Honesty should be one of the requirements on admission to the school, tested for during probation, and forever more. However, to keep the arithmetical account correct, it is better to make one person or one group responsible, for the cash value of the goods is very high.

Moral Responsibility.—People of all ages answer "yes" to the question, "Am I my brother's keeper?" The nurse learns to take up this burden when she watches over cocain or morphin, to prevent others from becoming drug addicts. She is not a useful member of the community till she assumes responsibility for the acts of those under her, preventing wrong, teaching right.

Preservation of Asepsis.—(1) Drugs may be dry sterilized (by counsel with pharmacist on effect of heat), wrapped in double muslin cover, and shaken over wound with aseptic precautions (*e. g.*, aristol).

(2) Some drug solutions may be boiled to sterilize (see pharmacist)—**not all.**

(3) Some drugs are powerful germicides themselves, but must be handled with aseptic precautions. (See chapter on Asepsis, *i. e.*, iodin on umbilicus last, then thrown away.) Collodion spreader should not be used and returned to bottle. Keep spreader in ether—drop collodion on, then spread. Made of ether and gun-cotton—an explosive; also inflammable.

(4) Find out at what stage aseptic precautions may cease.

(5) Keep printed codes of rules on boiling, heating, or steaming drugs and solutions.

Methods of Computing Cocain Solutions.—Quick methods of calculation are not reliable, because, with the average young woman's dislike of mathematics, and the

strain of operating-room emergencies, the result is mental paralysis.

There must be a sound reasoning process developed, and each problem must be worked out on paper and submitted for the examination of a supervisor (old rule of three).

Stock may be

A. Tablets.

B. Solution (do not let cloud).

A. *Tablets, gr.* $\frac{1}{6}$.—Problem: ℥j of 4 per cent. solution (to remove small cyst, etc.). (See Chapter XI on Formulæ and Directions.) Grains v to ℥j = a 1 per cent. solution.

I. If a 1 per cent. solution = 5 gr. to ℥j,
Then 4 per cent. solution = 4 × 5 = 20 gr. to ℥j.
II. If in ℥j of a 4 per cent. solution there are 20 gr.,
Then in ℥j there are $\frac{1}{8}$ of 20 = $2\frac{1}{2}$ gr.
III. If in 1 grain there are 6 sixths (as per stock),
Then in $2\frac{1}{2}$ gr. there are $2\frac{1}{2}$ × 6 = 15 sixths.

Take 15 tablets from stock for 1 dram of sterile water.

(The addition of adrenalin counteracts depression and enhances local vasoconstriction.)

B. *Solution, 20 per cent. Strength.*—Problem: Make ℥j of 4 per cent. solution.

Amount required = ℥j or 60 minims.
Stock solution 20/4 or 5 times as strong as solution required.
∴ strong stock dose must be only 1/5 of total amount prepared.
1/5 of 60 = 12 minims.
Take 12 minims of stock solution + 48 minims sterile water.

Method of Computing Hypodermic Dosage.—A is the most difficult problem ever given any nurse in this division. Use the old-fashioned Rule of Three.

Example A:

Stock tablets nitroglycerin gr. 1/100. Dose ordered, gr. 1/16. How give it exactly?

Ratio of gr. 1/100 to gr. 1/16 is as 16 to 100, 4 to 25, which is less than 1/6 and more than 1/7.

therefore gr. 1/16 contains not quite 7 and more than 6 times gr. 1/100.

therefore dissolve 7 tablets marked gr. 1/100 and take proper proportion of solution, thus:

7 tablets should be dissolved in some number of minims that is a multiple of 7.

It must not be too large or too small to inject into the arm, as 28 minims.

If 7 tablets or 7 times 1/100 gr., or 7/100 gr. = 28 minims (dissolved in)

then 1/100 gr. = 4 minims solution

and gr. 1, or 100/100 gr. = 100 × 4 = 400 minims

and gr. 1/16 = 1/16 of 400 = 25 minims. 28 — 25 = 3.

Expel the air and 3 minims. Administer 25 minims.

Example B:

Stock tablets, morphin, gr. $\frac{1}{6}$. Dose ordered, gr. $\frac{1}{8}$.

Which is the stronger? gr. $\frac{1}{6}$.

The number of minims in which to dissolve the tablet must be approximately right for injection into the subcutaneous tissues.

It must also be a multiple of 8, the denominator of the dose required.

Multiples of 8 are 16 and 24—24 is too large for hypo. injection—take 16 minims of sterile water to dissolve gr. $\frac{1}{6}$.

If gr. $\frac{1}{6}$ = 16 minims,

Then gr. 1, or 6/6 = 6 × 16 = 96 minims.

and gr. $\frac{1}{8}$ = $\frac{1}{8}$ of 96 or 12 minims of that solution. 16 — 12 = 4.

Expel 4 minims and give 12 m.

Example C:

Stock tablets, morphin, gr. $\frac{1}{8}$. Dose required, gr. $\frac{1}{6}$.

Which is the stronger? gr. $\frac{1}{6}$. Then take two-eighths of a grain, dissolve in some suitable multiple of the denominator of the dose required—6, 12, or 18. Choose 18, as it will be reduced, and dissolve two eighths.

If gr. $\frac{2}{8}$ be dissolved in 18 minims sterile water,

Then gr. $\frac{1}{8}$ equals $\frac{1}{2}$ of 18 = 9 minims,

and gr. $\frac{8}{8}$ (or gr. 1) equals 8 × 9 = 72 minims,

and gr. $\frac{1}{6}$ taken, equals $\frac{1}{6}$ of 72 = 12 minims

18 − 12 = 6.

Expel 6 minims and give 12 m.

Legal Phases.—Nurses should not dispense, measure, or weigh out powders, etc., not being licensed pharmacists. Small hospitals should protect their patients and their own reputation by keeping within the law. An institution receiving public funds should retain an attorney to advise on these knotty points, where copyrights, inland revenue, or the restrictions imposed by the law to protect certain professions which are ethical, and to protect the people from quacks and untrained practitioners, are concerned.

CHAPTER XIII

DRESSINGS

General Principles.—Simplicity must be the keynote. To introduce fads is to shackle the workers and imperil the patient. Print the rules for cutting and putting up on heavy cardboard. Limit the styles and number of sizes of sponges as far as consistent with the best results for the greatest number of patients. Pupils should take permanent notes of measurements, etc. Houseclean methods once a year. Exercise economy. Each institution should record its standard measurements and numbers in packages.

Gauze.—(A) *Sponges.*—See Fig. 25. Usually three simple styles are enough for the biggest hospitals and the most famous surgeons.

1. Probangs, or small sponges for long sponge sticks.
2. Flat gauze or folded compresses.
3. Tape sponges (laparotomy) or long rolls uncut.

The probang may be made slightly larger for tonsil work, the area being more vascular, with fewer chances to suture or ligate. Demonstration needed. Flat gauze must be cut to measure, and all loose edges turned in. The marvelous precision of the trained Red Cross workers in making dressings could put to shame many nurses. The patients do very well now with a light abdominal dressing, such as a few compresses.

Tape sponges are cut to measure, made by hand, and heavy metal rings caught on tape to prevent loss in the abdomen.

Dr. H. S. Crossen of St. Louis describes in the Journal of the American Medical Association, vol. 81, No. 19, November 10, 1923, his method of sponging from one long sterile roll in a pocket on a towel over the patient's side, absolutely eliminating all need of sponge count.

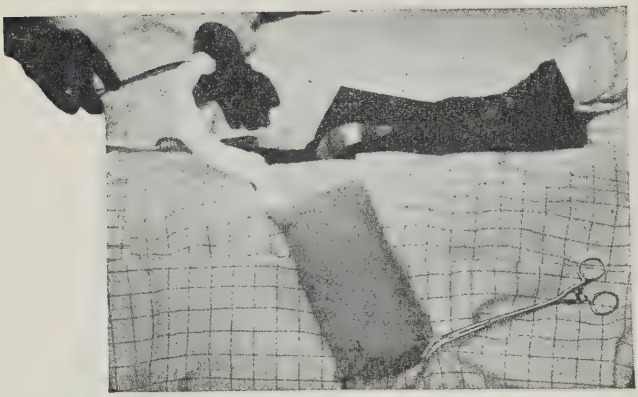


Fig. 25.—Use of the gauze strip sponge: Ready to sponge with the end of the strip. (H. S. Crossen in Jour. Amer. Med. Assoc.)

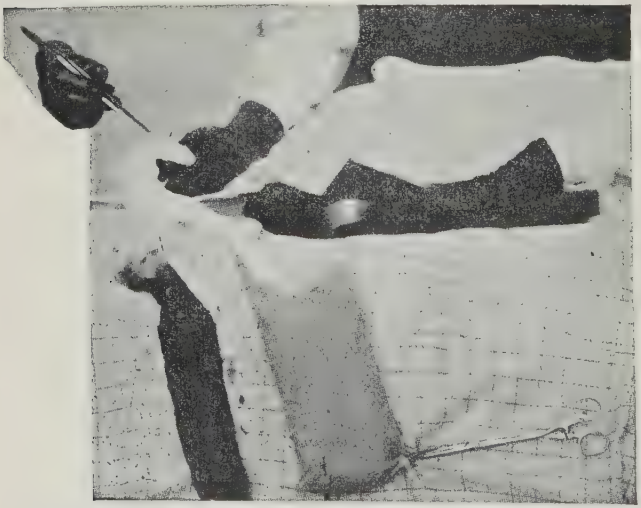


Fig. 26.—Use of the gauze strip sponge: The soiled portion gravitates out of the field. (H. S. Crossen in Jour. Amer. Med. Assoc.)

To safeguard the patient from infection, hemorrhage, and hernia his wound is covered next with two or three

thicknesses of wide iodoform packing, then he is sheathed heavily in enormous quantities of adhesive. If he is not specialed continuously, he may sit up or get out of bed.

B. *Mastoid Tips.*—It is most gratifying to be able to hand the proper style of dressing to a surgeon who has not previously visited the hospital. Operations relating to the special senses (eye, ear, nose) are entitled to some special dressings. Mastoid tips are arrow-shaped sponges, whose point enters small pus pockets in the cells of the mastoid bone.

Cut the yard wide folds of gauze into 16 squares, 4 to a side, twenty layers. Lay one pile flat. Pull a piece off with the left hand. Catch it by the right forefinger and thumb in the very center, and, closing the left hand, pull it through. Lay this "arrow" to the right side, with the nose pointing away and the tail nearer. After about a thousand are made, pick them up with the right hand, place the noses in an even row or cluster, turn and trim off the ragged ends with one "snip" of large bandage scissors, leaving the "tips" 6 inches long. Put up in bundles of 30, in double muslin, evenly laid.

C. *Mastoid Dressing.*—Arrange for sterilization in the double muslin squares as follows:

1. A square of blue tissue to keep cotton fluff off the cover.

2. A square of best absorbent cotton 6 inches each side (for an adult), then blue tissue, then another square of cotton.

3. A piece of plain gauze packing, 9 inches long and $\frac{1}{2}$ inch wide.

4. A gauze roller bandage, best quality, 2 inches wide, which sets well when it is moistened on account of the sizing in it.

D. *Gant Pad.*—Used for hemorrhoidectomy or prolapsed rectum. Make the usual flat folded compresses, each one-quarter of the large gauze square yard. With all the raw edges turned in, these are $4\frac{1}{2}$ inches square, as measured up to the patterns cut, or lined in the surface

of the work-table. Take two compresses and cut each in half. Turning in that raw edge, fold the first half-piece in four equal layers, the second in five, the third in six. Roll the fourth in a tight, hard roll, keeping tight temporarily with a safety-pin in the center. Lay them in a pyramid, the widest at the bottom, to make a wedge. Take two strips of adhesive, each 6 inches long and ½ inch wide, and wind the ends together tightly. This causes the wide bottom layer to lie flat, and each one above it to bulge more and more. When the convex side is laid against the anus, the whole being pressed home with a very tight perineal binder the convexity is increased. When well lubricated, it forms a good dressing for a prolapsed rectum or bleeding hemorrhoids, being secured by stout adhesive straps from buttock to buttock.

E. *"Whistle" or Tampon Cannula.*—This prevents oozing of blood after hemorrhoidectomy by exercising pressure in the rectum (or anal canal).

The advantages are:

(1) Blood can show in the outer dressings.
(2) Flatus may escape painlessly to the patient.
(3) Enemata may be introduced.

A piece of stiff rubber tubing 3 inches long is sterilized, smeared with sterile vaselin, and wrapped around with plain gauze, vaselin being rubbed in at every turn of the cloth. Wind the gauze spirally at what will be the entering or proximal end, so that it presents the form of a truncated cone. Slip a large safety-pin through the distal end, so that it may not entirely disappear into the rectum. Finish with split gauze compress pad and a T-binder.

F. *"Canule a Chemise" (Petticoated Tube).*—(1) Gauze is gathered about the end of a piece of rubber tubing, just like the cloth of an umbrella at the ferrule of an umbrella, hanging down loosely from it like the unbound umbrella. (2) Or a sponge may be rolled over a medium-sized tube (or rubber-dam over gauze), the ends are secured with ties of catgut, and lubricated well with boric acid ointment. The tight end is inserted in the rectum, the loose part

acting as a drain and a fluffy pressure pad, all being well smeared with vaselin.

G. *Leg Rolls.*—The *selvage must be cut off everything, always,* to produce a softly yielding spiral when applied. Cut off three thicknesses of the yard-square gauze in one piece, folding over so that the selvages come together. Then pare them off very sparingly. Then cut in two, down the center fold, making thus two pieces, ½ yard wide and 3 yards long. Open out, turn in the ends about 2 inches, fold long edges *almost* to the center, and fold over, making a strip 4½ inches wide. Hold squarely on the solid work table and roll very evenly. Put up in packages of two.

H. *Stump Dressing.*—Six strips laid in the form of a Maltese cross.

I. *Eye Pads.*—(1) To prevent ether eyes, cut a piece of gauze 8 inches square. Fold it on itself laterally. Leaving a space of ½ inch in the center, bounded by vertical stitching, pad it to fill in the hollows of the eyes and nose, so that when it is laid on the face, random drops will not pass through. (2) Others take 20 thicknesses of gauze, 14 x 20 inches, and bind with 1-inch tape, and quilt on the machine. Hole in the center to fit the nose, in half the number of pads made, not in the others. Put up one of each, in cover. Sterilize. When opened, the notched one goes next the face, the square one above.

J. *Fornices of the vagina* are best packed by plain sponges, in a hurry, in postpartum hemorrhage. But if the doctor desires a strip, hand him a small strip for the uterus and heavy for external—no threads.

K. *Bandages.*—Every nurse should be an expert bandager, so that the doctors would leave that to her. Especially she should be able to apply a bandage with the edge turned in, and deftly catch it with needle and thread to stay in position.

L. *Packing.*—Use the best of gauze in sheets, with threads drawn—strips cut—folded, or the best of gauze bandages with the sizing washed out. If not, it is *very*

painful to remove (being set with blood and sizing). Label packing according to its complete width when opened. Sit with right foot on a low stool. Turn in the end of the strip, then turn each edge to center. Then fold the two halves together, which makes the final strip only *one-quarter* the open width. Roll the first few inches with both hands into a tape-like roll. Then pin securely as much as is finished. Then, holding the raw bandage or strip, in the left, and the finished roll in the right, turn the edges in to the center, and again, with a sawing motion over the knee, aided by the fingers of the left and applying traction with the right. Pin securely every few inches, after rolling up steadily with the right. Use the same only two pins, and do not lose them. They alternate like cribbage pegs.

Use a pin point packer (Dr. Dench's packer for lifting up grafts of skin from the spatula) to plait packing into tubes.

Tubes should be open at both ends to permit passage, from end to end, of live steam. Plug at both ends with cotton and put up in double muslin covers, labeled outside, according to width when single.

M. *Retractors.*—Long strips of gauze are used, held by a nurse, in ear work.

Cotton.—A. Cotton balls must be made of the finest grade of absorbent cotton, on account of the extreme delicacy of the field where they are used—the eye. It is not good to use cotton in other fields because it leaves threads internally that become a foreign body.

B. *Aristol Pledgets.*—For ear work. Take a very thin shred of the finest absorbent cotton, and pick it, till a circle $\frac{3}{4}$ inch in diameter remains, then gather all the shreds into it toward the center, and lay it on a glass slab, rolling it with the tips of the second and third fingers, back of the hand horizontal as at the piano. With practice, these may be rolled into perfect balls, like the "pills" of the opium addict. When a large number of these are made, of assorted sizes, they are then stirred about in a

square glass basin containing about ℥ij of aristol, till they carry all they can. They are then sterilized in jars.

C. *Applicators (Long) for the Ear.*—The soiled piece on any applicator must always be pushed off by a piece of clean cotton. The knack is to wind it tight enough to operate and loose enough to remove. Demonstration is required. Take a thin shred of cotton about 1 inch square, of even thinness. Lay the tip of a 6-inch double wooden ear applicator in the center. Roll the cotton trumpet shaped, fastening it by indentation with the thumb-nail at the base. Wind both ends—place in glass tubes open at both ends—put up in double muslin and sterilize.

D. *Toothpicks (Short Applicators) for the Eye.*—Choose toothpicks of pine or cedar, rather rough, cut square, and bellied in the center—not the fashionable (?) rounded cafe toothpick, too highly polished to catch and hold the cotton. Pick into a thin square a wisp of absorbent cotton, best quality—fold into a triangle, like a diaper—lay the end of the toothpick (first weak half-inch broken off, lest it break in operation) in the middle of it, and roll, finishing by indenting with thumb-nail at the base. Then to make it smooth and pretty *revolve* it with the right hand, holding the cotton cone between the tips of left thumb and second finger, beveling it into shape with the tip of the forefinger. These are discarded after using. If inserted into an infant's nostrils, the cotton must not come off nor the end break.

E. *Applicators All Cotton.*—For babies' noses a long, stiff, slender rod of rolled cotton is most safe, as it cannot break nor abrade.

Tampons.—Required—lambs' wool, or best grade absorbent cotton, smooth stout cotton cord (knitting cotton No. 4) or heavy white linen thread, and the medications required. Cut in squares $4\frac{1}{2}$ inches to the side. Roll fairly snug. Throw a double line, by its folded end, twice around the waist of the roll. Pass the free ends through the noose and work tight, then steep in the medication required.

For a very young patient at the first examination tampons may be made in small clusters, like balls ornamenting articles of worsted, as small as a cherry.

Cotton 1 inch square and $\frac{1}{2}$ inch thick—wind with noose at center—spread the ends of the cotton to meet over the cord and trim till round and even. Then the number needed can be gaged to the cavity.

Boroglycerite must be set on a plate and the bottle washed after using, as it escapes in large quantities.

Linen Bobbinette.—This is used for

Tying umbilical cord,
Cigarette drains,
Scalp wounds—drain,
Rubber tubing with iodoform.

Muslin Bandages.—Tear off selvages and ravel smooth. Use factory cotton (unbleached muslin) of good quality. Cut into 5-yard lengths. Cut each end into the desired widths, with little snips for markers. A piece 36 inches wide, minus selvages, should make 17 2-inch bandages, allowing for ravelings. Two nurses collect the loose tabs, Miss A taking 1, 3, 5, 7, etc., Miss B taking the alternate 2, 4, 6, 8, etc., firmly in both hands, and, walking away from each other $2\frac{1}{2}$ yards, they tear all the strips at once. Wind on bandage roller, split the end, tie one knot, and tie around.

Flannelette bandages the same. *Never cut hand-made bandages* off a patient. Unwind and wash.

Wick should be kept in small quantities for drains, syringes, etc.

Chiropodists' Plaster.—A neat way to finish bandages on fingers or toes is to secure with chiropodists' plaster from spools. Neck bandages are wide and may be tied, by leaving the first end loose and one foot long, to be caught when done, in with the last. Tying is more comfortable for the patient. Adhesive should not be used near hair, nor pins near the eyes or blood-vessels.

Cloth Retractors.—These are intended to hold the soft parts out of the way during an amputation, while the

bone is actually sawed. A piece of stout unbleached muslin, 2 feet long and 1 foot wide, is torn lengthwise half-way, into two or three tails, put up in double muslin cover, and sterilized. Two tails are needed for the humerus or femur, three tails (leaving the middle narrow tail for the interosseous space) in the forearm or leg, because these have two bones. (Gauze bandages used likewise in small radical ear operations.)

Tape Stickers.—These should be made to suit various sizes of abdomen and wound, considering also the danger of hernia from obesity or distention. Use the best quality of adhesive, no matter whether it is on spools or rolls, though that by the roll seems economical in cutting the widths.

For solidity in handling use a piece of basswood splint as a back, 9 inches long and 3 inches wide. Nick the end of the sheet of plaster in 2-inch or 3-inch widths (p. r. n.) ready to tear, and tear the required length, *cutting* them off below. Carefully remove the crinolin, part of which is to be used again. At one end fold down one corner squarely on itself a little beyond the center (about $1\frac{3}{4}$ inches), then the other, uniformly on top of it, making an even folded point. This overlapping past the center gives three thicknesses to hold the tape. Now fold this point on itself and make a V-shaped nick all the way through. Then lay the strip on the basswood, gummy side to, so that the ends are flush, and it adheres for 4 inches. Fold back on itself, and apply the crinolin to the remaining space as far as the folded tip. Take now 9-inch lengths of $\frac{1}{2}$-inch white tape, make a nick 1 inch from the end, running *lengthwise* with the tape. Slip the short end through the hole in the adhesive, then thread its long end through its own eye. Make six to a splint.

T-Binders.—These may be made up in the linen room, well stitched to endure a long time, but frequently they are hard to find. One can make a T-binder quickly from a muslin bandage, as follows: For a woman patient of medium height and girth take for waistband 36 inches of

a 2-inch muslin bandage. Fold it in the center *crosswise*, and slit it for $\frac{1}{2}$ inch, the cut running lengthwise with the bandage. Take for the perineal strap a second piece, 24 inches long, and fold it *lengthwise*, 3 inches from the end, slitting it crosswise for 1 inch. Thread this short bit through the hole in the waistband, then thread the long end of the 24-inch strip through its own eye. For a male patient split the perineal strap for the last 18 inches, to secure the dressings at the groin. This strap saves safety-pins.

Ether Cones.—The ether cone made with several folds of newspaper and a small towel, pinned and stuffed with gauze, is the most satisfactory yet. Actual demonstration is required for its peculiar knack.

Making of Supplies.—This must be supervised by the operating-room head nurse. The surgeons should take counsel as to who shall make dressings: (1) Probationers; (2) operating-room pupils; (3) convalescent clean patients; (4) Junior Auxiliary; (5) Red Cross; (6) church groups; (7) friendly special nurses. The effectiveness of the sterilizers should be beyond a doubt, then in times of stress outside help of this sort, under hygienic conditions, could probably be safely utilized. If the dressings are not made in the operating room, at least the suture nurse should learn how to take charge of the work. Distinction may be made between ward dressings and operating-room supplies.

CHAPTER XIV

LINEN OF THE OPERATING ROOM

Estimation of Stock Required.—Quite careful study is needed to estimate properly the quantity of linen needed for an operating-room. A chart similar to that appended (p. 224) may be compiled.

Whiteness of Linen.—This is determined by

(*a*) The method of washing,
(*b*) Where dried,
(*c*) How stains are **prevented,**
(*d*) How stains are taken out,
(*e*) The nature of the goods,
(*f*) The chemicals in the water-supply,
(*g*) Special goods for isolation,
(*h*) Improper sterilization—burning, not steaming.

(*a*) Washing white goods:

(1) Nurse sends down, ready—put linen in cold water in machines.

(2) Rinse cold twenty minutes.

(3) Warm water and soap twenty minutes—wash by machinery.

(4) Warm rinse ten minutes—very important.

(5) Hot water and soap twenty minutes—wash by machinery.

(6) Hot rinse five minutes—very important.

(7) Hot rinse five minutes.

(8) Hot water and 4 ounces of acetic acid to the machine, for ten minutes.

(9) Cold water, add the blue, ten minutes.

Wyandotte soda precipitates lime salts (with chipped soap). Buy by the barrel. Anilin blue (No. 90) in 1-pound cans is purchased for the coloring. (*b*) The water should be analyzed. See that the servants do not buy

LINEN CHART

I.	*Uniformity*	Towels must be all of one style for one service—*e. g.*, with a blue check. This gives distinction. If a change is made, make it complete—giving all the old color to the wards. Differences jar and break the sequence of thought. Some newly equipped hospitals find gray restful to tired eyes.
II.	*Method of caring for linen*	In the last analysis it does not increase the amount required to take time to mend it. Prolonging its life reduces the amount to buy. It is bleached, mended, exchanged on exhibiting the old, etc. A towel with holes is not sterile.
III.	*Illness among pupils, orderlies, etc.*	Climatic conditions, *e. g.*, low sea-level in raw cold climate inducing colds of various forms—epidemics among poorer districts—poor hygienic conditions for nurses—poor food—affect the service and cripple it.
IV.	*Possible emergencies in the community*	Railroad disasters—mining large industrial center types—military events—building operations—are the basis for a reasonable forecast, similar to that made by the insurance actuaries.
V.	*Number of pupils in the operating service*	If there are enough pupils to keep newly arrived linen from the laundry folded, done up, and sterilized, the amount required is minimized.
VI.	*Types and number of surgical cases*	Count in last annual report the number of tonsillectomies, appendectomies, etc., demanding less than gall-bladder cases or hysterectomies.
VII.	*Efficiency of sterilizers, number, and field*	Must allow for repairs—break downs—fractional sterilization— number and size of drums and chambers estimated on the peak load of the service. An efficiency expert should determine this + the shortest period required in the cycle of using, laundering, and sterilizing towels.
VIII.	*Laundry service, speed of cycle, extent*	The left hand of the operating room—its equipment estimated on the peak load of the operating-room. Laundry help must not steal linen. Nurses must soak and pick off linen before sending down, to leave automatic share to the help.
IX.	*First class durable quality of stuffs*	Pays to get the best, then take good care of it. Nurses here are taught how to take care of linen in private houses.
X.	*Kinds of cloth required*	Huck—hand towels, ether cones. Unbleached muslin—bandages, sheets, breast binders, vaginal sheets, etc. Flannel for masks and blankets (stretcher and chest). Flannelette for patient's suits, bandages, binders. Pure linen—gowns, towels. Cotton bird's-eye—towels. Lawn—masks.
XI.	*Purse of the hospital*	Wealthy—lavishly outfit the operating room, where great stress is. Those staggering under deficit should work harder and faster, to turn smaller stock over oftener.
XII.	*Status of board and accessory bodies*	Large cities furnish few volunteer workers to make garments. Small towns have "home-made" gowns, etc.

sulphuric acid themselves for quick bleaching. It has been known to occur. Drying in the open air is the best way. If not possible, certain articles at least may be held back, and dried and wet again repeatedly till white. To have a large number of articles and bleach with sunlight is more economical than to have a few and let them be eaten by chemicals. Do not buy advertised "aids" till they are analyzed. (*c*) Nurses should be taught to handle linen without letting it get stained. For iodin, argyrol, bichlorid of mercury, etc., only old mended articles should be used. (*d*) A code of formulæ should be framed in the hopper room, giving the suitable instruction for every sort of stain that may occur. Nothing that rusts should be washed with the linen. (*e*) Some twilled goods are naturally dough colored. Linen, on the contrary, takes a beautiful white. (*f*) Rivers into which waste is poured from factories are a bad source of water-supply.

(*g*) Rust on white goods may be removed by

(1) Cream of tartar paste + sunshine—or
(2) Lemon juice and salt, or
(3) Rust soap.

Grease (vaselin, etc.) disappears on application of ether, but this is costly.

Bichlorid of mercury makes a gray stain, removed by Javelle water, or Labarraque's solution, diluted 1 : 6. Formulæ for Labarraque's: Sodium carbonate 10 parts; chlorid of lime, 8 parts; water, 100 parts.

(*h*) Do not send good material to isolation for two reasons: It takes a long time to get back, and by some mischance it might not be disinfected, so, coming to the common center, redistribute contagion through the hospital. Use large old linen ends for contagion or dirty staining dressings.

Training Economics.—A priceless part of a nurse's training is that under a competent housekeeper on the points of contact with the other phases of domestic science. It looks as if at some time nursing might be

made one of the branches of that bigger field. She may learn how to arrange the work for others, to buy goods, to provide materials, and to co-ordinate the efforts of all on whom she must depend for her own success. To be comprehending, systematic, economical are most essential in one who wishes to hold office worthily anywhere.

Measures.—The book of measures shall contain the quality, price, addresses of manufacturing firms, sizes, and patterns of all the garments mentioned following. The pupils should learn these details to see their successful application, so as to build up similar, and, it is always hoped in one's pupils, better systems when they hold office.

Here should be a carefully made card of samples kept shrunken and unshrunken, with this book, showing the smoothness, number of threads to the inch, etc., to train in good buying. Goods should be bought about twice a year to save time and expenses in freight, and to train in forethought. The use of a good thread gage is taught.

Nurses' Gowns.—Nurses should have well-fitting gowns. They vary more in stature than men do, and the distance of a gown from the floor is more vital to a woman. A sloppy gown cannot be aseptic. It should be ironed.

Doctors' Gowns.– Usually these look uncomfortable. A square yoke shrinks, and if rough-dried, is smaller still, therefore hangs too far forward in the front, and hunched up behind. A round yoke is better looking. The goods should be shrunken before making, or ordered a size larger. The unshapely gown often seen cramps the arms. All should be ironed. Hospital outfitters usually make good gowns without yokes and inexpensively.

Doctors' Suits.—No man wishes to wear trousers made by a Women's Auxiliary. The great garment-making houses make these suits at such a low figure, due to organization, that volunteer workers cannot rationally compete. The suit should be of soft material, being worn over the underwear and under the gown.

Shields.—Muslin (bleached) is used for the shields in front of a students' or visitors' stand.

Covers.—The instrument table which swings directly over the laparotomy sheet is best covered with a bag, made like a pillow case, the under side being as dangerous as the top.

Masks, Helmets, Mouth-pads.—Masks for the suture nurse resemble a helmet, coming well below the neck band

Fig. 27.—Suture nurse's mask, New York Post-Graduate Hospital.

of the gown (see Fig. 27), with an opening only for the eyes. For the attending surgeon, who will lecture in his clinic, the opening is larger. For the intern a small square of a few thicknesses of gauze, with four tapes to the back of the head, is considered enough, as he is a resident, and not out in the streets or crowds previously, or in the homes of infectious cases.

Suspensories.—These should be kept in stock in the operating room. If not, they can be made from a couple of yards of 4-inch muslin bandage and applied with a few safety-pins by the orderly.

Laparotomy Suits.—These are made of thick, fine Canton flannel, open at the back, with tapes only. *The stockings should always go with them in sets.* Each set should be folded to show its stencil—

X. Hospital.
Lap. suit.
Length, 54 inches.

This length (neck to heel) helps the nurse select for her patient. The only safe place to keep these usually is in the operating-room linen closet. The suit should be changed, after the surgeon closes the wound, for a dry set, warming in the blanket warmer.

Scultetus Binders.—Nothing but Canton flannel of best grade will do for these. Remove the selvages. The measure of a binder for a patient is as follows: (1) The tails must each be four-fifths of the patient's girth or once the patient's girth, less the width of the back piece. (2) The back piece should be one-fifth the patient's girth, and reach from the bulge of the thighs to the breasts. One most annoying feature of the surgical service is the dearth of well-made, well-ironed, large enough Scultetus binders, due to perspiration, accidents, and delay in laundering till a number accumulate. Many patients wear them home, due to carelessness of the ward nurse, or the patient's dishonesty or ignorance. These binders, if made by the nurses in classes, will not be cut or lost so often as the pupils will realize how costly they are. There are two rules in applying this binder:

(*a*) For obstetric cases, braid from the top down.

(*b*) For surgical cases, braid from the bottom up.

There are ten tails, cut, not torn, overcast finely by hand on all edges, not hemmed.

The back piece is made from double its size, allowing for the making, the fold being at the hips, as in all binders, so that the patient does not lie on a seam. Baste first throughout.

The tails are set in securely $\frac{3}{4}$ inch, for firmness when braiding.

Fig. 28.—Binder for breast amputations—sleeve spread to show pattern.

Each tail should overlap the next for three-fourths of its width. They must overlap in the same direction on both right and left sides of the back piece.

Allowance must be made for the thickness of a dressing when selecting.

Goods must be shrunken before making up.

Maternity Breast-binder with Sleeve.—This makes an ideal support for the dressings in a breast amputation (see Figs. 28 and 29) by adding a plain sleeve, ordinary style, men's coat-sleeve, of double unbleached muslin. Open the sleeve on the outer surface, in a line running from the ring finger to the tip of the acromion process.

Fig. 29.—Binder for breast amputations—sleeve folded.

Close this, when the dressings are on and the binder applied, with four pairs of tapes (8 inches long). It corresponds with the opening of the breast-binder at the shoulder, whose flaps extend about 1 inch past the sleeve on each side. The binder may be used for either breast, being reversible. The sleeve ends above the elbow.

Caps.—Outside of the amphitheater nurses should wear, anywhere else in the suite, caps that cover the hair completely. A very thin material, slightly starched, will do. It need not fit down on the top of the head too closely, but the style must be uniform for the service. On leaving the suite for other parts of the building, the school cap is put on.

Laparotomy Sheets.—The opening should be not more than 10 inches long by 6 inches wide, making at any moment about a 16-inch ellipse, *e. g.*, in cesarean section. The sheet should be wide enough to cover a very large abdomen and fall 6 inches below the edge of the table. For length, it must reach from the neck to the heels (including the length of the foot) plus 6 inches, but may be extended by placing another smaller sheet over the knees. Assorted sizes must be kept and marked. For babies a small slit in a large towel is good.

Vaginal Sheets.—As shown in Fig. 30, a large number of sheets are required, that minimize the sense of exposure. They are easily put on over the sterile triangles which cover the stirrups. This sheet is so securely fastened that it makes above the abdomen a sterile table for the instruments. It is much more comfortable and economical than towels clamped in position. The set consists of

2 triangles so folded as to make 2 halves of a square.
1 vaginal sheet.
In 1 muslin cover (if not loose in drums).

A triangle is an unbleached muslin cone to cover foot, leg, and thigh.

Gown Covers.—For reserve gowns, outside the drums, covers should be made (Fig. 31, *a*) like a pocket book, into which they are slipped, and secured with dome fasteners, saving time and vexation. These are particularly nice for a private physician's kit. Glove envelopes are made also like a pocket book (Fig. 31, *c*, *d*).

Covers for Packing Tubes.—Make a long, double tubular bag (Fig. 31, *b*) with a drawstring at the neck, put the tube in, fold over the loose end, to close, and tie

tightly. Allow three per tube in stock daily needed. One is on the tube, one being laundered, one in reserve. Washing prolongs the life of this stock.

Dressing Covers.—The process of sterilization has been proved futile inside a thin cover. Covers must be double,

Fig. 30.—Vaginal sheet.

of stout unbleached muslin, stitched smoothly, with the name stenciled carefully outside. These covers are used for reserve stock or for ward use.

Blankets.– The top blankets for stretchers should be of some dark color, preferably crimson, to be gay, and not

show stains. They should be of pure wool, of generous

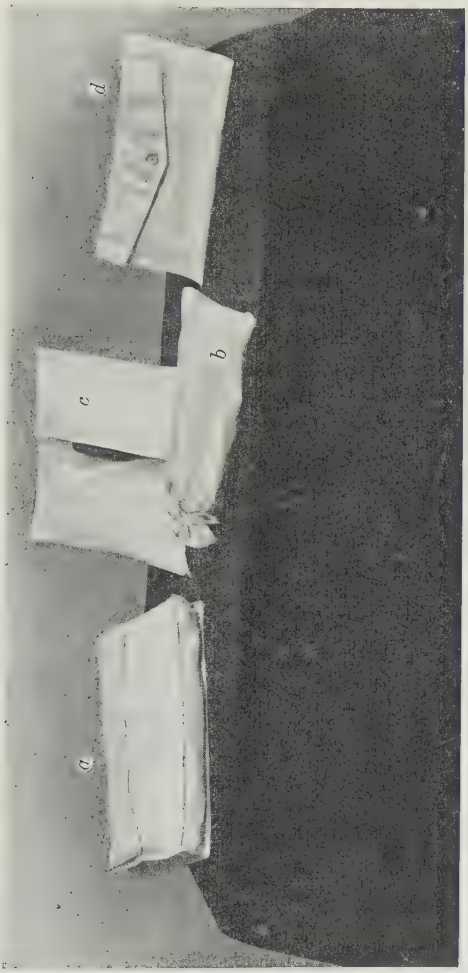


Fig. 31.—Some special covers: (*a*) Gown cover; (*b*) cover for packing tube; (*c*) glove case; (*d*) glove envelope.

length, from the crown of the head to the sole of the foot and over. They may be extended by a second blanket

from the knees down. Heavy cotton blankets are worse than useless. They are to be kept clean, so as to remain unspoiled by washing. Towels may be folded over them at the chin. The supervisor must sign slips when blankets are sent to the laundry, and if one comes to the head of the laundry without a requisition, it should be held up.

Flannel Masks.—These are made by hand, washed with green wool soap and rinsed in warm water, to which a few

Fig. 32.—Gown and towel plaited in one direction—opening too easily with one movement.

drops of glycerin are added. Stretch well, and dry for a time outdoors.

Folding Linen.—There are two methods of folding linen. By one the article is taken at its full length and folded often enough to be a convenient width—a towel once, a gown twice— then simply plaited, so that it may drop to its full length by only gently lifting one edge

(Fig. 32). When a doctor is putting on a gown it is presented to him with the collar uppermost. He takes it by the collar in a clear space in the room, and as he raises it it drops its full length. But the trouble with this method also arises from that very feature. Things opening too easily might be easily contaminated. The one counterbalances the other. The second method is to fold the article from its ends toward its center so as to control it perfectly.

To fold a towel 24 by 30 inches or of similar proportions, lay *k–o* over on *a–e*, *pressing* the fold *f–j firmly*. Bring

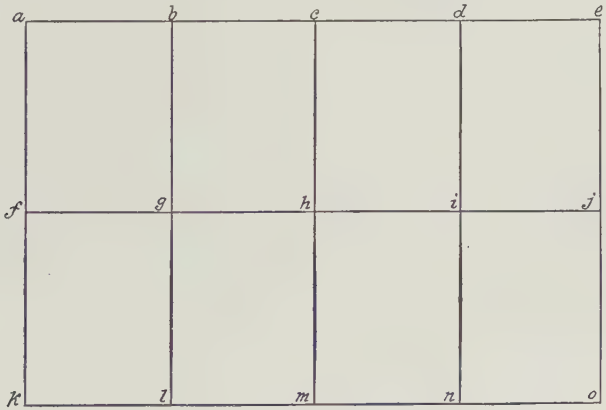


Fig. 33.

the double edges *a–k* to *f* and *e–o* to *j* to the center *c–m* to *h*, *almost*, but not quite, to prevent a hump. Now fold from *b–l* to *g* and *d–n* to *i* to the center again. Then fold together. In opening this towel hold the folds at *d* and at *b* in the right and left hands respectively, between the forefinger and second finger. Hold the points at *a* and *e* between forefinger and thumb also. Keep the two thumbs close together and the whole towel compressed until, having wedged a way between two assistants, one has space close beside the area to open the towel out sud-

denly like a fan and lay it *in situ*. This method keeps the whole bottom edge, *k–l–m–n–o*, securely fastened between the thumbs until needed (Fig. 33).

In **folding gowns,** hold by the under arm seams and let drop longitudinally into four thicknesses. The nurse keeps the under arm sides next to her and makes them the straight edge. The sleeves are turned (together) at a sharp right angle to this line, straight across the gown, and when they reach the opposite edge sharply folded back on themselves, perfectly flat and square. *Do not* bring the sleeves down along the body of the gown. Turn in tapes into the inner part of the openings on the farther edge. Fold from the collar and the bottom in *almost* to the center. By leaving 1 inch in the middle the folds lie flatter. By applying great firmness and long, steady strokes even linen that is rough dried may be made quite beautiful. A nurse's hands ought to be as good as a mangle. All these articles should be laundry mangled, but binders are ironed. However, the laundresses do not *fold* for the sterilizing. The method of folding should be uniform throughout the hospital. If large sheets and blankets are folded in and in, they present a handsome appearance, since it hides any dissimilarity in stripes, while things of varying sizes that *have* to be used for the *same purpose* can be approximated to look the same, but laparotomy sheets and gowns must be folded in their assorted sizes to be selected quickly.

There should be a large stock of bags in the workroom for dressings, both sterile and unsterile, ward, reserve, and operating-room supplies. These may be of stout unbleached muslin, carefully stenciled and very frequently laundered.

CHAPTER XV

TERMS USED IN SURGICAL DIAGNOSIS

Reasons Why Nurses Should Know the Diagnosis.—(1) If the mistress in a small thorough-going *menage* prepares her own meals, she can be splendidly helped by an intelligent maid if she states her menus twenty-four hours in advance. Similarly, though on a different plane, if a surgeon states that he will operate for cholecystitis, the nurse will be able to assist him very much better than if he just says "laparotomy," because her class instruction with her supervisor enlightens her as to the nature, size, and number of instruments required, owing to the number of "layers," dressings, etc.

(2) In the routine work of the operating room the circulating nurse signs a slip for the enlightenment of the ward nurses, showing diagnosis, operation, stimulation, etc. She must therefore be able to grasp the terms when given and to spell them, *i. e.*, to have a working knowledge of them.

(3) The hospital takes care of the *present* and of the *future* of its patients, but the operating-room pupil loses the *past*, or history, entirely, and thus is not equipped as well as she ought to be to cope with those conditions found in the home, before diagnosis is made, where nine-tenths of all sickness occurs. Hence it is a most important duty of the supervisor to sketch the conditions preceding the operation, to associate them with the particular diagnosis in question. This must be done hastily, and is a very slim weak link with the nurse's after life as a private special, where her observation of symptoms should be of such untold value to a cautious surgeon.

Pathologic tissue means diseased tissue, in this instance to be treated surgically. It may be diseased by in-

flammation, benign or malignant tumors, cysts of a watery or purulent nature, malformations, transformations, congenital absences of parts and other deformities, besides those resulting from accidents and wounds. All terms ending in *itis* denote inflammation of the part named, as *cholecystitis*, inflammation of the gall-bladder.

TABLE OF TUMORS

Normal tissue.	Tumors found therein.
Fibrillar connective tissue	Fibroma singular, fibromata plural. Greek nouns ending in *oma* form plural by adding *ta*.
Mucous tissue	Myoma.
Embryonic connective tissue	Sarcoma.
Endothelial tissue	Endothelioma.
Fat tissue	Lipoma.
Cartilage	Chondroma.
Bone	Osteoma.
Neuroglia	Glioma.
Muscle tissue type	Myoma.
Smooth muscle tissue	Leiomyoma.
Striated muscle tissue	Rhabdomyoma.
Nerve tissue	Neuroma.
Vascular tissue (veins and arteries)	Angioma.
Lymph vessels	Lymphangioma.
Glands	Adenoma.
Various forms of epithelial cells and associated tissues	Carcinoma.

Compiled from standard works

CYSTS

Cysts are sacs filled with watery, purulent, or cheesy material, and are of two kinds: (I) Those developed from pre-existing cavities. (II) Those originating independently after pathologic changes.

Class I is formed by an accumulation in a gland or its excretory ducts of secretion (altered somewhat) when pressure or inflammation hinders normal discharges. This secretion is either mucous, sebaceous, or serous. To these belong the comedone, milium, ranula, chalazion, atheroma, milk cyst, ovarian cyst, cysts of fallopian tubes, of gall-ducts, the transudation cysts due to chronic

inflammation in the lymph-spaces or serous sacs—namely, ganglia, hydrocele, and hematocele.

Class II is formed (1) by the softening and disintegration of tissue (*e. g.*, from old abscesses); (2) or by the formation of a wall around foreign bodies (parasites, masses of blood producing an inflammation and becoming encapsulated); (3) or by new growths in whose spaces various kinds of fluid accumulate, quite like glands, as adenomata on the ovaries, though they are called cystomata; (4) or congenital cysts, dermoid cysts of the ovary or of subcutaneous tissue (as the scalp), being probably part of another fetus.

GLOSSARY OF TERMS

A

Abortion. Expulsion of the contents of the pregnant uterus before the child is viable (end of sixth month).

(1) *Abdominal.* Escape of fertilized ovum into peritoneal cavity, where it attaches itself to the intestine.

(2) *Complete.* The sac comes away intact.

(3) *Criminal.* Procured artificially without being necessary from the legal standpoint of the patient's health.

(4) *Epidemic.* Arising from the presence of contagious disease.

(5) *Habitual.* Repeated, due to syphilis usually.

(6) *Incomplete.* When the membrane or placenta is retained.

(7) *Inevitable.* When the sac has ruptured and the fetus is about to appear.

(8) *Septic.* When the patient becomes infected through the introduction of bacteria or the decay of retained tissue.

(9) *Spontaneous.* Not induced by artificial means.

(10) *Therapeutic.* Induced to save the mother's life.

(11) *Threatened.* Appearance of symptoms which are checked by putting the patient to bed and giving her

opiates. This usually can check an honest miscarriage in the early symptoms.

Abscess. A localized collection of pus surrounded by a wall of leukocytes.

Cold Abscess. Tuberculous, usually about a bone, joint, or gland—slight pain, no acute inflammation, very slow.

Psoas Abscess. Both *cold* and *psoas* are misnomers, generally low Pott's disease; pus from the spine runs along the psoas muscle pointing beneath Poupart's ligament. The psoas muscle runs from the lumbar vertebræ to the lesser trochanter of the femur. Poupart's ligament runs from the anterior superior spinous process of the ilium to the symphysis.

Adenoids. Hypertrophied tissue in nasopharynx. Note the spelling of pharynx (y = i, rynx = rinks. Pronounce farinks).

Adenoma. May become malignant, as sarcoma; many are benign, but some are most malignant—an epithelial tumor.

Amenorrhea. Abnormal absence of menstruation.

Aneurysm. A circumscribed dilation of the walls of an artery.

Angioma. A tumor formed of blood-vessels—benign.

Anomaly. An abnormal thing or occurrence, a marked departure from the normal.

Anteflexion. A bending forward or doubling on itself forward.

Antrum. A cavity or hollow space in a bone, as in the mastoid, often infected; antrum of Highmore in the superior maxillary.

Appendicostomy. Opening the vermiform appendix at the tip and irrigating the colon downward for the purpose of eliminating the germs which make that their abode.

Appendix (Vermiform). Small blind gut hanging from the cecum.

Ascites. Obstruction of portal circulation in chronic heart and kidney diseases causing a collection of fluid in

the peritoneal cavity. To let off this transudate we "tap" or do a "paracentesis" with a trocar, which passes through without infecting the peritoneum, with aseptic precautions.

Asphyxia. Suffocation: lungs deprived of oxygen.

Atheroma. A sebaceous cyst containing cheesy material.

Atresia. Lack of normal opening, *e. g.*, to the vagina.

Atrophy. Diminution in the size of a tissue, organ, or part.

Atypic. Not resembling its type; irregular, freakish.

B

Bartholin's glands. Vulvovaginal glands whose tiny openings appear about at the center of the inner surface of the labia minora, a seat of venereal infection.

Benign, Benignant. Not endangering health or life.

Bile-duct. The haunt of the Bacillus coli communis, the typhoid germ, etc.

Boil. A furuncle; a localized inflammation of the skin and subcutaneous tissues, with formation of pus.

Bone-grafting. A new field in surgery, dating from about 1911, where a healthy bone is planted to splint and support or take the place of an unhealthy one, the callus thrown out by the irritated bone forming union, *e. g.*, the tibia to the spine.

Bubo. Suppurative inflammation of a lymph-node, usually in the groin and usually venereal.

C

Cachexia. Depraved condition of general nutrition due to syphilis, tuberculosis, or carcinoma; weak, tough, yellow, muddy skin, and emaciation.

Calculus. Stones in the ureter, kidney, gall-duct, or bladder, sometimes causing occlusion of the ureters and consisting of uric acid, oxalate of lime, phosphates or cystin—a stone-like concretion inciting pyelonephritis—when in the gall-ducts, of bile pigment. See *Gall-stones.*

Capsule. A receptacle or bag; covering of certain organs, *e. g.*, the kidney, the liver, some cysts, and parts of the eye.

Carbuncle. Hard, circumscribed, deep-seated, painful, suppurative inflammation of subcutaneous tissue, larger than a boil, with a flat top and several points of suppuration.

Carcinoma. Malignant epithelial tumor prone to local extension through the lymph-spaces. It may appear at any age and may have inflammation, ulceration, and hemorrhage. It is more frequently found in some parts of the world than in others. The age limit is said to be *lower* now only because patients are handing themselves up sooner to physicians and the complex life of this time ages people faster. Epithelioma occurs in skin where it joins the mucous membrane on the lips, eyelids, labia, mouth, esophagus, vagina, or cervix. It may not recur if thoroughly removed, and is the least malignant of the carcinomata. Cylindric-celled carcinoma occurs in the stomach, intestine, and uterus. Carcinoma simplex occurs in the mammæ, stomach, liver, thyroid, salivary and prostate glands, in the pancreas, testicle, ovary, and kidney. Some of these are the most malignant. There has been no serum or toxin yet discovered as a cure, but early recognition and early radical operation save many lives.

Caries. Death of bone; similar to ulceration of soft tissues.

Caruncle. Small, fleshy growth, frequent in women, in the meatus urinarius.

Chalazion. A tumor of the eyelid from retained secretion of the meibomian glands.

Cholecystitis. Inflammation of the gall-bladder.

Cholelithiasis. Presence of stones in the gall-bladder or gall-duct composed of bile-pigment, that is, cholesterin and certain salts. By lying together they become faceted, and may exist in as large numbers as 7800.

Cholesteatoma. Cells packed with cheesy matter,

benign tumors in the dura behind the ear; found in mastoid operations.

Chondroma. Benign tumor of the covering of cartilage, but it may extend into the lungs or heart.

Cicatrix. A scar; connective tissue replacing a local loss of substance, the new being red or purple, the old white, hard, shriveled, and shiny.

Circumcision. Removal of foreskin or prepuce for cleanliness and prevention of self-abuse.

Cirrhosis. Chronic inflammation of an organ and overgrowth of connective tissue.

Clitoris. A very small organ in the female in front of the pubic joint, somewhat resembling the penis in the male, and extirpated to check self-abuse.

Colic. *Appendiceal.* Pain and rigidity of spasms due to inflammation.

Biliary. Passage of gall-stones through the gall-duct into the duodenum.

Intestinal. Severe griping pain in the bowels due to spasm of the intestinal walls.

Renal. Pain caused by stone in the ureter.

Comedo (sing.), **Comedones** (pl.). Disorder of the sebaceous glands; in the young, yellowish elevations with black points in the center associated with acne.

Condyloma. A wart-like growth or tumor near the anus.

Congenital.—Existing at and since birth.

Convergent. Coming together, as in squint.

Cornu (sing.), **Cornua**—*horns* (pl.). The projecting upper corners of the uterus into which open the fallopian tubes.

Culdesac of Douglas. A pouch between the front wall of the rectum and the back wall of the uterus made by the peritoneum.

Curetage. Curetment—scraping out the uterus. It is essential for the honor of the hospital to have a true history.

Cyst. A cavity containing fluid and surrounded by a capsule.

Cystocele. Hernia of the bladder. The back wall of the bladder drops down, pushing out the front wall of the vagina, the weight of urine increases this, and finally may pull down the cervix and the uterus.

D

Decapsulation. Taking off the capsule of a diseased organ to establish new circulation and reduce inflammation, as of the kidney, for nephritis or bichlorid poisoning.

Dermoid cyst. A sac containing hair, teeth, nails, and other forms of epithelial tissue.

Detritus. Waste matter from disorganization.

Dilation. As correct as *dilatation*—act of stretching.

Distal. Farther away from the point mentioned.

Divergent. Going apart, as in squint.

Diverticulum (of bladder or esophagus). A pouch or sac springing from a weakness in the wall of a main structure, causing the contents to stop there which should pass on; symptom of diverticulum of esophagus in an adult, regurgitation of food just as sweet as when swallowed.

Dorsum. The back of the hand, foot, tongue, etc.

Dura Mater. Membrane covering the concave surface of the skull, "exposed" in ear operations under strict aseptic precautions, "going in" from outside, or the outermost of the three coverings of the brain.

Dysmenorrhea. Painful menstruation.

E

Ecchymosis. Large diffuse accumulation of blood in the interstices of the tissues.

Ectropion. A disease of the eyelid turning it inside out.

Effusion. A pouring out of blood or serum into serous cavities (pleura, peritoneum, pericardium).

Embolism. Blocking of a blood-vessel, especially an artery, by foreign matter.

Embryonic. Pertaining to the embryo, or fertilized ovum of an animal.

Encapsulated. Surrounded by a capsule, as a bullet or any other foreign body.

Endometritis. Inflammation of the lining of the uterus, with swelling, congestion, and even hemorrhages.

Endothelioma. A sarcoma in the lymphatics.

Endothelium. Lining of blood- and lymph-vessels and of serous and synovial cavities.

Entropion. A disease of the eyelid turning it outside in, so that the lashes constantly scratch the eyeball.

Epididymitis. (Note spelling.) Inflammation of epididymis, small organ lying above the testes.

Epispadias. Opening of urethra, not at the end, but on the upper side of the penis, due to arrested development.

Epithelioma. Carcinoma of the skin and mucous membranes.

Exostosis. Bony tumor; an abnormal projection of bone.

Extra-uterine pregnancy. Gestation outside the uterus, in the tube, fimbriæ, peritoneum, or on the intestines.

Extravasation. Passing of fluid outside of a cavity in which it normally ought to stay (of blood or lymph).

Exudate. The material that has passed through the walls of vessels into the adjacent tissues (said of serum or pus).

F

Fascia. The areolar tissue forming layers beneath the skin or between muscles.

Felon. Inflammation of flexor tendons and tendinous sheaths of the finger. See *Paronychia, Whitlow.*

Fenestrated. Having a window or opening, as in a rubber drainage-tube, a pair of obstetric forceps, or a plaster cast over a sinus.

Fibrin. Coagulating material in blood; small bunches of twigs are used to whip clots to separate the fibrin in looking for fetal or placental tissue.

Fibroma. A tumor, benign at first, in skin and sub-

cutaneous tissue may become serious through pressure, ulceration, etc.

Fissure. A groove or cleft (normal) in the skull, brain, liver, cord, etc.; an abnormal fissure occurs at the junction of skin and mucous membrane, as the lips or the anus.

Fistula (sing.), **Fistulæ** (pl.), **Fistulous** (adj.). A narrow, winding, irregular canal in the soft tissues left by incomplete healing of an abscess or wound with fluid contents; must be entirely laid open and the edges beveled off so as not to approach again (usually rectal).

Flap. A piece of soft tissue cut on three sides of a square and laid back to cover a scar, or to bring forward after an amputation to cover a bone end.

Floating. Free to move around; abnormal, as a kidney, which has no ligaments at all to hold it up, merely fat.

Fossa. A depression or pit.

Frenum. A rib or fold of skin or mucous membrane that limits the movement of any organ. Under a newborn infant's tongue an abnormal frenum should be promptly snipped or it cannot nurse and will be tongue-tied.

Frontal sinus. Hollow air-spaces in the frontal bone; a seat of infection that becomes fatal at times through the easy way of reaching the brain; operated through the nose.

Furuncle. A boil.

Furunculosis. The constant formation of a succession of boils.

G

Gangrene. Death of a considerable mass of tissue. When it is mummified, dry and hard, brown or black it is classified as *dry gangrene;* when discolored and putrefying, *moist gangrene.* It proceeds from wounds, diabetes, and other causes. It is not a cause for panic now, as formerly, in hospital wards.

Glaucoma. Disease of the eye, with heightened tension, hardness of globe, lessening of visual power, restriction in field of vision, dreadful headache, etc.; relieved by iridectomy.

Glioma. Tumor of neuroglia cells in the brain, cord, retina, nerves, and suprarenals; benign.

Granulations. Formation of new vascular but nerveless tissue in repair of wounds.

Gumma. Third stage of syphilis in the brain. Should take precautions against contagion. It is a tumor with a gummy appearance, consisting of granulations and showing peculiar degeneration.

H

Hematocele. Blood extravasated into a closed cavity.

Hematoma. Collection of blood in a tumor-like mass on a newborn infant's "caput," be it the head or buttocks.

Hemophilia. All words with the prefix *hem* (for blood) as their root should be spelled *hem* uniformly. Hemorrhagic diathesis, condition of being a bleeder. Important question to ask in taking a history. When circumcising a newborn infant he proved a bleeder, and after all other means failed, a large number of the tiniest clamps ever made, covering the whole wound, saved his life.

Hermaphrodite. A human being whose organs are so malformed as to partake of the nature of both sexes.

Hydatid Mole (*hydatidiform*). Hypertrophy of the villi of the chorion, beginning as a fibrous mole; then its mucous membrane degenerates, then a hydatid mole.

Hydrocele. Accumulation of fluid (serous) in the tunica vaginalis about the testicle or the spermatic cord.

Hydrocephalus (the noun, note ending *us*). A head containing a collection of fluid in the cerebral ventricles, with steady increase in size.

Hydrosalpinx. Fallopian tube dilated with water into the shape of a cyst.

Hymen. A fold of mucous membrane partially closing the virginal vaginal opening.

Hypospadias. The male urethral opening into a cleft on the under side (arrested development).

Hypostasis. The settling of blood in the dependent or low-lying parts of the body.

I

Ileus (volvulus). A twisting of the bowel so as to obstruct the passage of air, feces, or fluid; usually fatal.

Impaction. A mass of fecal matter or calculi solidly packed; stones in the cystic duct cause dilation of the gall-bladder; very large stones sometimes cause occlusion of the gut.

Imperforate. Without a normal opening, as of the anus (a hole from the rectum often leads to the vagina instead).

Incarcerated. Walled in and bound around, as a hernia in a sac.

Infarction. A circumscribed portion of tissue completely infiltrated with blood.

Infiltration. The entrance into the tissues (1) of some abnormal substance or (2) of some normal substance (as blood) in too great a quantity.

Inflammation. Heat, swelling, redness, pain, and impairment of function; a rush of leukocytes to fight the invasion of bacteria.

In situ. In the natural position.

In statu quo. In the natural condition.

Intercostal spaces. The muscular areas between the ribs, numbered.

Intussusception. Slipping of one part of the intestine into the part beyond; telescoping of the bowel on itself, as the ileum into the colon.

Invagination. Act of insheathing or being run into a sheath, as inverting the raw end of the appendix stump inside itself.

K

Keloid. An overgrowth of tissue standing out like a very full frill, usually in any old scar, and very common in the negro race.

Kidneys. Subject to inflammation, have no supporting ligaments, malformations quite common, as two in one or one missing, or one with two ureters, have tumors of various kinds; the healthy one should not be removed by mistake, this being the result of carelessness in marking specimens obtained after catheterizing the ureters.

L

Laceration. A tear, especially of the cervix or perineum in childbirth; repair is imperative.

Lamina. Plates or layers applied to vertebræ.

Laminectomy. Removal of the posterior arches of the vertebræ.

Lateral. Belonging to the side; in a sideways direction.

Leiomyoma. Benign tumor of involuntary muscle.

Lesion. An injury, a wound, or any diseased morbid condition in an organ.

Leukocytes. White corpuscles.

Leukorrhea. Whitish mucopurulent discharge from the female genital canal.

Lipoma. Benign, fatty tumor.

Lobe. A rounded part of an organ, separated from the others by fissures or clefts.

Longitudinal. Lengthwise; in the longest direction of the body.

Lymphangioma. Benign, but may rupture; a tumor made of lymphatic vessels.

M

Malformation. An abnormal development or formation of a part of the body.

Malignant. Applied to tumors; harmful, fatal. Known if (1) they spread by metastases; (2) they invade adja-

cent material by eccentric or peripheral growth; (3) they tend to recur; (4) they interfere with the nutrition and general well-being of the body, inducing cachexia.

Malposition. An abnormal position of any part or organ.

Mastitis. In infants streptococcic or staphylococcic infection. Use no pressure, no massage. Inflammation of the breasts found in nursing mothers.

Mastoiditis. Inflammation of mastoid cells behind the ear.

Do not confuse these two terms.

Median line. A line in the center of the body from the umbilicus to the symphysis pubis; imaginary.

Menorrhagia. Excessive menstrual flow.

Metastasis (sing.), **Metastases** (pl.). Transfer of diseased particles by the blood or lymph from the primary bed to a distant one.

Metrorrhagia. Uterine hemorrhage; *not* connected with the menses or childbirth.

Microcephalon. An abnormally small head.

Milium. Small, pearly, non-inflammatory elevations on the skin due to plugging of sebaceous glands.

Mole. Birthmark; a pigmented nevus.

Mouse-tooth. Forceps with sharp teeth like a mouse's. Do not be guilty of saying "mouth-tooth."

Multilocular. Having many cysts or "eyes"—middle (*l*) put in for ease in pronouncing.

Multiple. Affecting many parts at the same time.

Myoma. Benign muscular tumor, frequent in the uterus.

Myxoma. A benign growth in connective tissue, but may recur; containing *mucin*, like Wharton's jelly in the umbilical cord.

N

Nævus or **Nevus.** Vascular birthmark; "strawberry mark"; an angioma full of blood-vessels, benign and congenital, corrected by skin-grafting.

Necrosis. Death of a limited portion of tissue due to insufficient nutrition by (1) cutting off the blood-supply; (2) bacteria; (3) mechanical injury.

Neuroglia. Has its origin in nervous tissue, but takes on the duties of connective tissue.

Neuroma. Benign tumor; new formed nerve tissue.

Node. A knob, swelling, or protuberance; the normal shape of many lymph-vessels.

Nodule. A little node.

Noma. Not surgical. An ulcer in the cheek rapidly spreading down the alimentary canal.

O

Obliteration. Removal or disappearance of a part.

Obstruction. Blocking of the blood or the bowel.

Occlusion. Closing or blocking off, as of the fallopian tubes, inducing sterility; or of the gall-duct with gall-stones.

Œdema or **Edema.** Infiltration of serum into a part.

Omentum. Useful for absorption and its fat supply; a fold of peritoneum hanging down like an apron in front of the intestines.

Oöphoritis. Note spelling, marking, and pronunciation, not like *oo* in *foot*, but like *oa* in *oasis*. An inflammation of the ovary after the puerperium, or it may be a primary affection.

Orchitis. Inflammation of the testicle.

Organized clot. Found in curetings; blood converted into something looking like an organ or other living tissue. When curetings are examined they should be whipped with a bunch of twigs to separate the fibrin so as not to miss a tiny fetus.

Osteitis or **Ostitis.** Inflammation of bone.

Osteoclast. An instrument for breaking bones (bow-legs).

Osteoma. When alone, benign; new formed bones found in the soft parts, such as the pleura or the diaphragm, but often combined with sarcoma.

Osteomalacia. A disease mostly of pregnant women; by the loss of inorganic salts bone which was hard and fully formed becomes softened and twisted, sometimes necessitating cesarean section.

Osteomyelitis. Inflammation of the marrow of bone.

Osteoplasty. Operation for bow-legs or knock-knees, for the cosmetic effect.

Osteosarcoma. A sarcoma containing bone.

Otitis Media. Inflammation of the middle ear. Diagnostic:

O. m. c. a. Otitis media catarrhalis acuta.

O. m. c. c. Otitis media chronica catarrhalis.

O. m. p. a. Otitis media purulens acuta.

O. m. p. c. Otitis media purulens chronica.

Ovary Transplantation. Taking a healthy ovary from one woman and sewing it into place in the body of another woman (1) to correct sterility; (2) to keep the valuable ovarian secretions acting to prevent neurasthenia or masculinity.

P

Papillomata. Warty growths, fibromata of the skin; a papillary outgrowth covered with epithelium.

Paracentesis. Puncture into a body cavity (ear, abdomen, bladder, thorax, cornea); a "paracentesis knife" for ear work has a very small two-edged blade, so small that it can pass through a small ear speculum.

Parenchyma. The essential or working part of an organ (*e. g.*, the kidney); the body without the covering.

Paresis. Some, but not complete, loss of muscular power (intestinal).

Paronychia. An inflammation of the flexor tendons and tendinous sheaths of the fingers. (See *Felon, Whitlow.*)

Patent. Open or exposed, as a valve.

Patulous. Expanded or open.

Pedicle. The stem or stalk of a tumor or cyst.

Pediculated Cyst. Growing from the broad ligament and having a pedicle.

Perichondrium. The fibrous coat of cartilage.

Perineum. The floor of the pelvis from pubes to coccyx (adj., *perineal*).

Peritoneum. Serous sac lining the whole abdominal cavity and containing the viscera (adj., *peritoneal*).

Peroneal. Pertaining to the fibula or small bone of the leg.

Do no confuse these three terms.

Periosteum. Fibrous covering of bone—not to be destroyed.

Periostitis or **Periosteitis.** Inflammation of the periosteum.

Petechiæ. Very minute hemorrhages into the skin; sometimes seen in the newborn and others (adj., *petechial*).

Phagedena. A rapidly spreading destructive ulcer of the soft parts.

Phlegmon. Inflammation with spreading of purulent exudate within the tissues.

Pia Mater. Membrane covering the convex surface of the brain, the middle one of the three meninges.

Pneumothorax. Air in the pleural cavity—(1) injury to the chest wall, going into it from without, (2) or from the lung channel, as if coming out, (3) or by ulceration or suppuration in adjacent organs, intestines, esophagus, etc.

Polypus. A tumor with a pedicle, as a growth in the ear, nose, bladder, uterus, urethra, or rectum.

Prepuce. Foreskin; fold of skin lined with mucous membrane under which dirt accumulates.

Primary Union. The clean joining of two edges of a wound, as in a herniotomy. One should always be very ambitious to have primary union of severed tendons; for instance, where function would be seriously impaired. Divided nerve ends cannot have union.

Procidentia. Prolapse, a falling down (of the uterus).

Prolapse. A falling down (as of the rectum).

Prostatitis. Inflammation of the prostate gland from old age, injuries, or gonorrhea.

Proximal. Of the two ends of an object; the nearer to a chosen point.

Psoas. Muscle of the loin and pelvis.

Ptosis. Drooping of the eyelid with loss of nerve power; dropping of the intestine or stomach.

Purulent. Not *pussy.* Containing pus.

Pus. Liquid formed of dead and living bacteria and leukocytes; also the fluids they have thrown off in their conflict in a part that has been inflamed.

Pustule. A small elevation on the skin containing pus.

Pyæmia or **Pyemia.** Following septicemia fresh suppurating foci are developed all over the body; metastatic abscesses.

Pyelitis. Inflammation of the pelvis of the kidney (the main part).

Pyosalpinx. A tube distended with pus.

R

Rachitis. Malformation of chest and bones due to improper nourishment. When placing a rachitic patient on the operating-table one is surprised to find such irregularities in the bones of the legs that they can hardly fit into the stirrups.

Ranula. A small tumor, very troublesome, in Wharton's duct obstructing the salivary fluid.

Rectocele. A sac of relaxed vaginal wall, posterior, pushed down by the relaxed front wall of the rectum.

Rectovaginal Fistula. Usually congenital; unclean; accompanying imperforate anus.

Renal. Pertaining to the kidneys.

Resolution. Return of a part to normal after some diseased condition, as of the lung in pneumonia.

Retained (placenta). Left in when it should normally come out, also as of a soapsuds enema.

Retroflexion. Bent backward on itself (uterus).

Retroversion. Falling back as a whole without doubling on itself.

Rupture. A bursting of a sac or blood-vessel (also of an inflamed appendix); the lay word for *hernia;* incorrect because there is only displacement.

S

Sac. A bag or the bulging cover of a cyst or tumor; in hernia, the bag growing around the dropped loop of intestine; a natural cavity.

Sarcoma. Travels by way of the blood-vessels, to distinguish it commonly from carcinoma. It is malignant and found in early life. It occurs in the skin, subcutaneous tissue, subserous connective tissue, fasciæ, periosteum, and choroid of the eye most frequently. It is also found in the brain, cord, lymph-nodes, uterus, ovary, bladder, and kidney, from which last it can be projected into the lungs and heart.

Sebaceous. Pertaining to the oil-glands of the skin.

Septicæmia or **Septicemia.** A condition in which bacteria and their toxins are distributed all through the body by the blood and the lymph.

Septum. A partition, may be deviated, in the nose; sometimes a double vagina is found with a septum between the two halves.

Seropurulent. Having partly the nature of both serum and pus.

Serous. Pertaining to or resembling serum.

Serum. Clear yellowish fluid separated from the blood after the coagulated fibrin is removed.

Severed. Cut in two, as a tendon or a nerve.

Sinus. (1) A large channel containing blood, as the lateral sinus, disturbed in some ear operations; (2) a cavity within a bone (frontal); (3) a worm-like opening from tissues for drainage in an old wound; an effort of nature to show that some foreign body has been left in, as silkworm-gut instead of chromic gut.

Slough. Death and throwing off of tissue, as after a deep burn.

Spasm. Sudden muscular contraction with pain.

Stenosis. Constriction or narrowing of a passage so that what should normally pass through cannot, as aortic stenosis or stenosis of the cervix.

Strangulated. Compressed and twisted so as to cut off the blood-supply, as in a hernia; black and gangrenous.

Strabismus. Squint. Do not say "strabismuth"!

Stricture. Narrowing of a canal from inflammation of its inner walls; frequently from infection, not always.

Subinvolution. Imperfect contraction of the uterus after childbirth.

Supernumerary. Extra, as of a thumb or any other digit sprouting out from the base of the normal one.

Synovitis. Inflammation of the synovial membrane; may be suppurative.

T

Teratomata. Congenital growths containing all forms of connective tissue (cartilage, hair, skin, teeth, nails, bone, glands), and found in the end of the spine, head, neck, glands, and generative organs, probably part of another fetus.

Thickening. A swelling due to old inflammation.

Thrombosis. Organized blood-clot blocking a vein.

Tight Lacing. Cause of displacement of kidneys, pancreas, liver, and uterus.

Torsion. Twisting, as a big tumor on its pedicle, becoming a strangulation.

Transposition. Wrong position from birth, as liver on the left, heart on the right, etc.

Transudation. Passing of fluid through a membrane, as blood through its vessel walls.

Trauma. Condition of being wounded.

Tubal Pregnancy. Growth of fertilized ovum in the tube.

Tubercle. A specific lesion produced by the germ of tuberculosis (the tubercle bacillus); a nipple or nodule of diseased tissue visible to the naked eye.

Tuberculosis of the joints or peritoneum is operable; opening for drainage or exposure to direct sunlight.

Tumors. Circumscribed new growths of tissue—nodular, tuberous, fungoid, polypoid, papillary, dendritic, or lobulated. Some are benign, others malignant.

U

Ulcer. Gradual death of the tissue of the skin or mucous membranes.

Ulceration. Necrosis with erosion (wearing off) involving the surface of the skin, mucous or serous membrane, due to inflammation or cutting off of nutrition.

Urachus. Remains of fetal life sometimes found in the abdomen during an operation for a different purpose; a canal about 6 cm. long, with a small opening into the bladder or entirely closed at that place; if there are certain congenital malformations the urine may flow through the urachus; in the adult a slight distention visible up to the navel shows that the urachus was never obliterated.

V

Varicocele. Veins of the spermatic cord dilated and forming twisted masses.

Varicosity. A swollen vein, knotted and tortuous, resembling a bunch of grapes.

Vascular. Having many blood-vessels.

Vesicovaginal Fistula. Requires a special bed; an opening from the bladder to the vagina with constant dribbling of urine; very common after childbirth, due to pressure and necrosis before the invention of obstetric forceps. If a patient's bladder is full the surgeon may snip it accidentally, causing a vesicovaginal fistula. Sims earned the eternal gratitude of his time by repairing it completely with silver wire.

Vicarious. Relating to an habitual discharge of blood in an abnormal part of the body, but never in the vagina, as a substitute for menstruation.

W

Walled-off. Shut in or bounded by a solid body of leukocytes in nature's effort to check the invasion of bacteria.

Wen. A sebaceous cyst.

Whitlow. Same as *Felon.*

CHAPTER XVI

NOMENCLATURE OF OPERATIONS

"Call a spade a spade."

TERMS CREATED BY THE WORKERS OF THE OPERATING ROOM IN CONTRADISTINCTION TO THE TERMS USED IN SURGICAL DIAGNOSIS OR PATHOLOGY

Careful Use of Terms.—The low standard in English set for entrance into a training-school for nurses causes a disagreeable condition which requires watchfulness and perseverance on the part of the supervisor of the operating room. Many pupils with limited vocabulary and powers of spelling pick up a new term of classic origin and reiterate it till all other persons are bored to death. The well-educated are masters of many languages, but use only the simplest Saxon. The derivation of all new terms must be thoroughly learned, with prefixes and suffixes, but these should be used only in technical conversation, not played with as a new toy. A surgeon has the just right to ask a nurse for the definition of any term he hears her use. If a junior nurse asks such a question, it is sure to be à propos of a certain case, and she is entitled to ample, exact information. The name of the operation appears usually about five times per case:

1. When posted in the office and on the operating-room calendar.
2. When the supervisor holds morning drill in anatomy for all cases listed.
3. On the slip sent to the ward, briefly specifying the salient features of the work done, to help the ward nurse care intelligently for the ether case.
4. On the chart in three places:
   (*a*) Opposite the hour at which it took place in that day's sequence of events to the patient.
   (*b*) On the patient's discharge slip.

(*c*) On the history sheet of operation, dictated by surgeon or assistant.

5. In the operating-room register.

The nurse should keep a record of the cases for which she scrubbed, by these technical names: "one iridectomy, one hysterectomy, one gastro-enterostomy, etc."

Model of Slip to Ward.—Pinned on the shirt or clipped to the chart goes the slip telling the ward nurse the nature of her duties to the ether case.

1. Date.
2. Patient's name.
3. Ward.
4. Operator and assistant (signs).
5. Operation.
6. Anesthetic.
7. Stimulation.
8. Drainage.
9. Condition.

Rules for Formation of Terms Naming Operations:

1. There are two parts to each name of an operation:
   (*a*) The anatomic area, where the work was done.
   (*b*) The nature of the work done.

These roots or parts of words are usually classic in origin (Latin or Greek). There are very few, but they may form an immense number of combinations by rearranging.

I. For example:

(*a*) Anatomic area
Chole—the bile
Cyst—a sac
} cholecyst—gall-bladder

(*b*) Ectomy—cutting off.

(*c*) Otomy—cutting into.

Therefore:

Cholecystectomy means removal of the gall-bladder.

Cholecystotomy means opening it and draining only.

II. (*a*) Anatomic area
Staphylo—palate,

(*b*) Orrhaphy—suturing,

Therefore, Staphylorrhaphy is repair for cleft-palate.

To make the full name of any operation, we usually place the name of the anatomic part first, and the suffix, describing the work to be done, last.

2. Knowing the why and wherefore helps to brighten what would otherwise be dull automatic work. It enables the nurse to reason out steps in surgical procedure, anticipate the surgeon's needs, reduce the patient's shock, and save on ether bills.

3. As to spelling, the usual rules of English are observed—final consonant doubled after a short vowel:

Benefit, benefitted,
Label, labelling.

4. There are exceptions to these, in general operating-room conversation, as far as the casual observer could judge. For example: (*a*) An opacity of the lens is called *cataract.* But the word *cataract* does not become the root or derivative of the name of its operation. The ophthalmologist makes an incision in the iris, out through which the opaque lens slips, permitting sight to be restored. This is properly called *iridectomy,* or cutting away part of the iris. The lens itself is not operated on, in a true sense.

(*b*) Again, a certain tense hard condition of the eyeball, due to the improper blocking of certain glandular secretions at their outlet is called *glaucoma.* But this is also relieved by iridectomy.

5. Sometimes a correct diagnosis is not made till the operation is well advanced, in which case the surgeon posts himself for an "exploratory" in the region of the gall-bladder, stomach, kidney, etc., especially when malignant growths are suspected and frozen sections examined.

6. If a nurse is not certain that she knows the correct term to use, she should use plain Anglo-Saxon.

7. It is usually agreed upon now that operations must be named anatomically, and not after the great pioneer surgeons who first relieved suffering by that method. Surgeons are immortal in the measure of their pioneering,

in their heroism, and devotion. It seems very meager reward to have an operation named after one, but while even this is being taken away, the pupil should be taught a thorough lesson on the immortal work of such men as Sims and Bassini.

8. Some words are misnomers, as in any other walk of life, due to slipshod methods of the past.

9. Some words formed according to rule result in a spelling and pronunciation that seem unique.

10. Some words require the insertion of an extra vowel or consonant on the principle of ease which enters into all parts of our language.

11. Where two vowels are adjacent, but belong to different syllables (and do not combine into a diphthong) the dieresis is placed over the second, as oöphoron, the ovary.

Roots of Classic Origin:

A. *Anatomic part.*

Adeno, relating to glands (neck, groin, axilla, etc.).

Chole, pertaining to bile.

Colo, pertaining to the colon (part of large intestine).

Colpo, relating to the vagina.

Cranium, the skull, or bony covering (*not* the brain).

Enteron, the intestine.

Gastro, pertaining to the stomach (where digestion is carried on).

Hysteron, the uterus.

Jejun, relating to the second part of the small intestine.

Lamina, a plate or layer (referring to the posterior vertebral arch).

Nephron, the kidney.

Oöphoron, the part bearing the egg (Greek, the ovary). Note the spelling and pronunciation (like oasis).

Ophthalmo, relating to the eye. (Note two pairs of consonants, *ph* and *th*). Pronounced off-thal-mo.

Orchi, relating to the testicle (genito-urinary).

Osteo, bone (Latin *os*, *ossa*). There are, naturally, many bones, and many varieties of operation on each, the particular part diseased always being specified. *Osteotomy*, division of a bone, but to ensure proper preparation, the bone must be named, tibia, femur, etc.

Ot, pertaining to the ear.

Proct, pertaining to the rectum.

Prostat, pertaining to the prostatic gland (genito-urinary).

Rhino, pertaining to the nose.

Salpinx, the fallopian tube.

Spermato, relating to the semen.

Tars, pertaining to the instep.

Ten, pertaining to tendons (in the eye, wrist, finger, etc.).

Splanchno, pertaining to the viscera.

Trachelo, relating to the cervix, or neck of the uterus. There is no word beginning with *cervi* to denote these operations.

Tracheo, pertaining to the windpipe only. Note difference from one above.

Uretero, relating to the two pipes or tubes from the kidneys to the bladder.

Urethr, relating to the single canal from the bladder to the outside.

Vas, the sperm duct.

B. *Nature of Work Done.*

-ectomy (Greek, *cutting off*), complete removal of the part specified.

-orrhaphy (Greek, *suture*) sewing up.

-ostomy (Greek, *stoma, a mouth*) making a new opening into an organ; usually in the intestinal tract, to get by an obstacle, likely a malignant

growth, to pass the contents along, for digestion, assimilation and excretion, gastrostomy, opening into stomach, through which food is taken, instead of by mouth.

-otomy (Greek *to cut*) cutting into, for drainage, or to reduce size.

-pexy, fixation to another organ.

-plasty (Greek, meaning *form* or *shape*), cutting and trimming off; straightening and smoothing, reducing to normal, for cosmetic effect, for deformity, for comfort, for repair, etc. (not preceded by disease).

-stasis (Greek, *causing to stand*) fixation.

Glossary of Terms Made from These Roots:

Adenectomy. The excision of a gland.

Cholecystectomy. Excision of the gall-bladder.

Coccygectomy. (kok-sij-jectomy). Note spelling, also cutting off long coccyx.

Colostomy. Formation of artificial anus by opening into the colon.

Colpeurysis. Dilation of the vagina by the colpeurynter (an inflatable bag or sac).

Colporrhaphy. Suture of the vagina.

Craniectomy. Removal of strips or pieces of cranial bones in microcephaliac fetus (obs.).

D. and C.:

(1) In a non-pregnant uterus, for tonicity, or exploration for malignant growths.

(2) In a pregnant uterus only for honest therapeutic measures and reportable to the Board of Health—often questionable, a cloak for abortions.

Enterostomy. Formation of artificial opening into the intestine, through the abdominal wall.

Gastro-enterostomy. Opening from stomach into intestine to get past some obstruction above the latter.

Gastrectomy. Excision of whole or part of the stomach.

Herniotomy. Radical cure of hernia by repair of muscles to prevent protrusion of viscera.

Hysterectomy. Excision of uterus (abdominal or vaginal route).

Iridectomy. Misnomer—should be qualified as "partial" or "incomplete."

Jejunostomy. Making an artificial opening into the jejunum, through the abdominal wall.

Jejunojejunostomy. Sewing two parts of the same gut together and making a mouth afterward at the point of junction so as to catch any portion of the intestinal contents lurking in the "vicious circle," like a plumber's trap, left above after a gastrojejunostomy. (Show by drawings.)

Laminectomy. Removing the posterior vertebral arches.

Myomectomy. Excision of uterine myoma.

Nephrotomy. Incision into kidney (abdominal or lumbar route).

Nephropexy. Fixation of floating kidney.

Nephrolithotomy. Removal of renal calculus.

Œsophagotomy. Opening into œsophagus. Note spelling.

Oöphorectomy. Excision of ovary (must specify left or right).

Ophthalmoplasty. Plastic surgery of the eye or accessory parts.

Ophthalmostasis. Fixation of eye by special instrument to permit operation.

Orchidectomy. Castration.

Osteëctomy. Excision of portion of a bone.

Otoplasty. Plastic surgery of the external ear.

Ototomy. Dissection of the ear.

Panhysterectomy. Total extirpation of the uterus (only).

Proctectomy. Excision of the anus or rectum.

Proctopexy. Fixation of rectum by sutures to another part.

Prostatectomy. Excision of prostate gland.

Pyloroplasty. Sewing and cutting around the pylorus.

Rhinommectomy. Excision of inner canthus of the eye.

Rhinoplasty. Plastic operation on the nose.

Salpingectomy. Excision of fallopian tube (must specify left or right).

Spermatocystotomy. Surgical incision of seminal vesicle.

Splanchnotomy. Dissection of viscera.

Splenectomy. Removal of spleen (interesting to note length of life afterward).

Tarsectomy. Excision of tarsal bones.

Tenonectomy. Excision of part of a tendon.

Tenotomy. Cutting a tendon.

Tenorrhaphy. Suturing two ends of a divided tendon (very delicate and important).

Thoracotomy. Opening for free pus in the pleural cavity.

Trachelorrhaphy. Repair of laceration of cervix uteri.

Tracheotomy. Cutting into the trachea (so that breathing may go on).

Tonsillectomy. Removal of tonsils (snare).

Tonsillotomy. Old methods of slicing off only the tops.

Ureterotomy. Incision of the ureter.

Urethrotomy. Cutting a stricture of the urethra (characterized as *internal*, etc.).

Vasectomy. Resection of the vas deferens.

The best specimen of these coined words is "hysterosalpingo-oöphorectomy," removal of uterus, tubes, and ovaries (avoided as long as possible).

Special Verbs Relating to Operating:

Anastomose. To join, end to end, as two sound pieces of gut.

Bloodless operating. Straightening limbs in congenital hip-disease; no external wound. See chapter on Orthopedics.

Bone-graft. Inlay, transplanting.

> Quite recent discovery; splicing an old, diseased bone, or injured member, with a sound piece, taken usually from tibia or fibula; tuberculosis or non-united fracture.

Bone-plate. Metal plate (varied sizes) screwed in place

with steel screw-nails into two approximated ends of broken bone.

Cesarean section. Note the spelling—mode of Julius Cæsar's birth.

Circumcise. Excise the prepuce of penis—without anesthesia in very young infants.

Clamp and cautery. Operating-room slang for operation on hemorrhoids.

Dilate. To increase diameter (vagina or cervix), "dilation" is correct English.

Excise. To cut away, usually on or near the surface.

Extirpate. To cut away deep-seated parts (uterus).

Graft. To place a small portion of skin, bone, nerve, periosteum, etc., to cover a defect in a corresponding tissue.

Immobilize. To fix, render motionless with splint, sandbags, or plaster cast.

Incise. To cut into, for drainage (as a boil).

Inlay. (See *Graft.*)

Kraske. Surgeon who relieved cancer of the rectum by removing the coccyx and part of the sacrum to form a new opening above the malignant growth.

Ligate. One method of treating hemorrhoids—then excising.

Needling. On the eye, following the primary iridectomy, lacerating a cataract with a needle, to afford entrance to the aqueous humor and cause absorption of lens.

Resect. Misnomer—used to mean removal of piece of organ, bone, etc. (empyema).

Trephine or *trepan.* Sawing into the skull, generally in three disks, to break off the small bridges remaining and minimize shock to the patient.

CHAPTER XVII

LISTS OF INSTRUMENTS FOR OPERATIONS

Dissecting Set:

1 scalpel to suit,
1 probe,
1 grooved director,
2 single tenacula,
2 dissecting scissors,
1 mouse-tooth forcep,
1 plain forcep,
2 retractors to suit,
Hemostats, Ochsner and Kelly, in numbers to suit.

A dissecting set + the instruments required for the specified anatomic region + suture set = total number required for any operation.

Nurse's set (when, more than suture nurse, assisting at wound):

1 pair straight scissors,
2 needle-holders with needles,
3 sponge sticks,
2 ligature carriers (aneurysm needles),
1 suture forceps,
4 towel clips.

Decompression—Cranium—Exploratory, etc.:

(*a*) *Instruments:*

Scalpels,
Mouse-tooth forceps,
Anatomic forceps,
Artery clamps,
Scissors,
Sharp retractors,
Periosteal elevators,
Trephines,
Probes,

Gigli saws with handles (Figs. 34, 35),
Bullet searcher (p. r. n.),
Rongeurs,
Sharp curets,
Mallet,

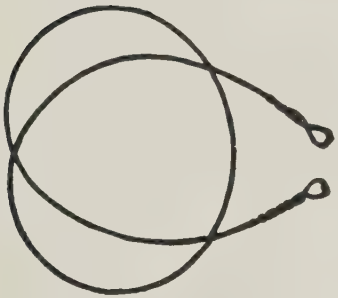


Fig. 34.—Gigli saw.

Fig. 35.—Handles for Gigli saw (in pairs).

Chisels,
Gouges,
Aspirating-needles and syringe,
Needle-holder (Fig. 36),
Needles.

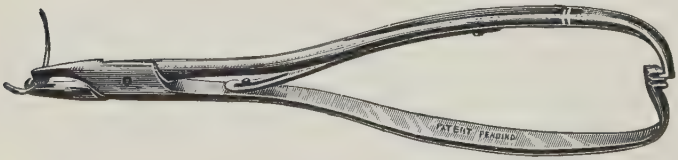


Fig. 36.—Richter needle-holder ($5\frac{1}{2}$ to 8 inches).

(*b*) *Needles:*

(1) Small round body for meninges with very fine catgut.

(2) Medium-sized curved Hagedorn, for scalp, with silkworm-gut or silk, to be removed, or

(3) Curved needle with cutting edge.

(*c*) *Accessories:*

(1) *Blood-pressure apparatus* (sphygmomanometer) for all intracranial work,
(2) Lighting of room,
(3) Headlight,
(4) Sand-bags,
(5) Sterilize electrodes; cover all electric appliances near wound with sterile gauze,
(6) Clippers, safety razor, and good common razor, with scissors,
(7) Hair at edge of shaved area plastered down with gauze strip steeped in collodion.

(*d*) *Sterile Goods:*

(1) Towels, laparotomy sheet, dressings, starch bandage as final dressing, wet well to set firm,
(2) Bandage around brow for constriction,
(3) Bone wax.

(*e*) *Notes.*—Head nurse in morning class to make a drawing of the various layers—hair, scalp, periosteum, bone, dura mater, pia mater, arachnoid membrane, and brain tissue.

(*f*) *Drains:*

Twisted catgut drains.
Rubber tissue also.

Mastoidotomy (New York Eye and Ear Infirmary notes):

(*a*) Instruments (including enough for the assistant):

5 rongeurs (McKernon, Adams, Janvier, Pyle, bulldog),
1 mallet,
3 chisels (graded),
3 gouges (graded),
4 spoon curets (graded),
2 ring curets (graded),
2 periosteal elevators,
2 sharp retractors,
1 mastoid self-retaining retractor,

2 Mayo retractors,
2 mouse-tooth forceps,
2 thumb forceps,
Michel clips,
2 grooved directors,
2 probes,
2 scalpels,
2 scissors (straight blunt and curved blunt),
1 needleholder,
12 artery clamps, 6 curved, 6 straight,
1 mastoid syringe (metal ground, no washers),
6 needles.

(*b*) *Needles:*

(1) 2 small curved round body for possible use of catgut Nos. 1 and 2, in narrow, deep cavities.

(2) 4 medium-sized full-curved Hagedorn, for silkworm-gut for the skin—scalp is tough, needing stout materials.

(3) Silk suture material in readiness.

(*c*) *Accessories:*

Nurse's set.
Long uterine dressing forceps are very handy to get goods out of jars.
Glass basin for alcohol, 95 per cent.
Medicine glass, smear glasses for microscopic examination of pus when found, slides, swabs.
Pitcher, saline.
Carbolic acid, 5 per cent., in basin to steep old-fashioned syringe with leather washers.
Sand-bag—small, flat, special—under the neck.

(*d*) *Sterile Goods:*

Laparotomy sheet, towels.
3 bundles special mastoid tips. (See chapter on Dressings.)
Special mastoid dressing.
Plain gauze packing, very narrow.

Iodoform packing.
One plug iodoform gauze for the sinus.
One narrow strip, plain gauze for the canal.

(*e*) *Notes:*

Usually the retractors are held by a pupil.
Special room, or darkened room.
Watch the ventilation.
In applying bandage, let down head of table, hold patient gently by the hair and the shoulders.
Watch for pus—do not wipe it away—put on slide.
Infections from this may travel all the way down the sternocleidomastoid.
Ward nurse must send patient up, free from pediculi, with hair combed and braided in the special mastoid manner, slanting toward the well ear.
Hair must be fastened down along the edge of the shaved area by a strip of gauze steeped in collodion, pressed on, and let dry.

Removal of Ossicles of Middle Ear—"Radical"—Malleus, Incus, Stapes: (Same as for mastoidotomy, plus):

(*a*) *Instruments:*

4 cotton applicators,
2 flap knives,
Specula (graded).

(*b*) *Needles:*

Use 10-day chromic gut No. 10.

(*c*) *Accessories:*

(1) Skin-graft taken from patient's thigh, into middle ear, which is denuded and now exposed permanently.
(2) Fine prepared sterilized animal membrane to cover graft to protect while "taking."
(3) Examine thigh, and renew dressing if required.

(*d*) *Sterile Goods:*

(1) Gauze strip for retractor, to pull ear forward, out of the way.

(2) Mastoid tips—dressing.

Resection of Jugular Vein (following sinus thrombosis after mastoiditis):

Always an emergency operation, chills and fever indicating a septic thrombus in the lateral sinus, to relieve which a portion is excised, and collateral circulation relied upon.

(*a*) *Instruments:*

Infusion set, for shock,
Blunt retractors, so as not to abrade or puncture the vein,
Extra stock of artery clamps,
Scrubbing-up set,
Dissecting set,
Needle-holder,
Nurse's set.

(*b*) *Needles:*

One with stout ligatures of plain catgut No. 3, to tie around the two ends of the vein before excising thrombus.

(*c*) *Accessories:*

Saline, cold and hot.
Iodoform and boric acid powders in sterile insufflators.

(*d*) *Sterile Goods:*

Plug of gauze for the sinus.
Flat gauze.
Square cotton pads.
Neck bandage—2 inch.
Safety-pins and adhesive.

(*f*) *Notes:*

Save the specimen for culture and immediate microscopic examination.
Have hot-water bottles in double flannel covers and other stimulation.

Skin-grafting (compiled from notes while assisting Dr. E. B. Dench), New York Eye and Ear Infirmary:

(*a*) *Instruments:*

Special skin-grafting razor, with thin edge, thick back, and handle adjusted at a slant,
Tissue curet,
Scissors blunt, curved on the flat,
3 spatulæ, assorted sizes,
2 packers (to pick at skin on spatula),
4 slides,
Cotton applicators,
One pipet,
One medicine-dropper.

(*b*) *Accessories:*

Tepid saline in glass dish,
Silver leaf (in book), sterile,
Rubber tissue,
Adhesive straps.

(*c*) *Sterile Goods:*

Towels, sponges, flat compresses,
Roller dressing,
Pledgets of aristol, sterile, in glass test-tubes, dropped to place.

(*d*) *Notes.*—Assistant keeps saline dropping on razor and on skin-grafts (equivalent to life blood), scissors or curet used on burned areas to level off excessive granulations.

Incision of Brain Abscess (following mastoidotomy, etc.):

(*a*) *Instruments:*

2 brain knives, curved and straight.
Spade retractors, square, very large.
Clamps.
Encephaloscopes, three sizes.

Radical for Infected Frontal Sinus.—A radical operation is made by a wound between the brows; a conservative or indirect is done intranasally. An acute infection at its first height may be successfully treated intra-

nasally, but a chronic or neglected acute case must be treated radically.

(*a*) *Instruments:*

Small trephine, diameter of not over 5 mm.
Scalpel.
Thumb forceps (dissecting).
6 artery clamps.
1 periosteal elevator.
Chisels and gouges (graded).
1 mallet.
Electric burr or drill, preferred by some operators.
Curets (graded).
Intranasal bone forceps of various types.
Wound retractors.
Probe.
Scissors (straight and curved on the flat).
Needle-holder.
Needle.

(*b*) *Needle:*

Hagedorn curved, with silk gut, for the skin.

Iridectomy (for glaucoma or cataract)—partial special method of anesthetizing by cocain at fixed intervals, previously:

(*a*) *Instruments* (usually owned by operator):

Right or left speculum.
Fixation forceps.
Cataract knife.
Iris forceps.
Iris scissors.
Iridectome.
Cystotome.
Spoon.
Iris repositor.

(*b*) *Accessories:*

(1) 2-inch bandage best grade gauze, double figure-of-8.

(2) Special woven woolen or linen bandage, p. r. n.
(3) Mask of black satin over all.

(*c*) *Sterile Goods:*
(1) Eye pads, flat gauze to receive lens when expressed.
(2) Cotton moistened in sterile water for sponging, to leave no threads.

(*d*) *Notes:*
(1) No pressure on eyeball.
(2) Assistant must be in good physical shape, to hold lens steady.
(3) Be sure which eye is to be operated on. *Safeguard the good eye*—cover it.
(4) Keep blood washed off instruments during operation.
(5) By instilling confidence in the patient his nervousness is reduced and he will not "squeeze" so much.
(6) The ethical behavior of the operating-room *personnel* largely controls the patient's behavior and the success of the result.
(7) All orders regarding catharsis, diet, wraps, etc., must be carefully written.
(8) The patient must be assisted in keeping his orientation by being told the direction in which each portion of the room, furniture, etc., is from him.
(9) *He must not be allowed to catch cold and sneeze.*
(10) No drafts—gentle handling—good if done on his own bed.
(11) Cleanse ivory handled eye knives in benzine, or in soapy water—metal handled knives in alcohol—rinse and wipe on soft old linen.
(12) Test knives on a drum for edge—kid glove wrist stretched over a napkin ring or tiny embroidery hoop.

(13) Boil blunt instruments only.
(14) The whole iris is not removed, merely a small section, which added to the pupil looks like a keyhole.
(15) Cork protects delicate ends of special knives.

Removal of Foreign Body in Eye:

Intra-ocular,
Intra-orbital.

The equipment of a small, clean, plain room for such important work fills a need in a community and brings or keeps a higher type of surgeon and patient, besides preparing nurses more broadly to do their community duty after graduating.

Accessories:

Magnet—Grant, Haab.
x-Ray plate and chart.
Non-magnetizable instruments.
Intense local illumination on stand or bracket.
Suction device.

Strabotomy—correction of strabismus (convergent; divergent):

(*a*) *Instruments:*
Speculum.
Fixation forceps.
Conjunctiva forceps and scissors.
Strabismus hook.
Tendon scissors and sutures.
Nurse's set.

(*b*) *Needles:*
(1) Small curved. Have ready early, with 6 black silk sutures (iron dyed) 8 inches long—called conjunctival sutures.

(*c*) *Accessories:*
Basin of bichlorid of mercury, 1 : 5000.
Carbolic acid 1 : 20.
Sterile water, adrenalin chlorid, argyrol, 20 per cent. fresh.

Tincture of green soap.
Adhesive.

(*d*) *Sterile Goods:*
Special pattern sponges.
Special fine cotton.
Gowns, gloves, towels, sheets.
Special eye bandages.

Enucleation of Eye:

(*a*) *Instruments:*
Speculum.
Fixation forceps.
Conjunctiva scissors.
Strabismus hook.
Tendon scissors.
Stronger scissors.

(*b*) *Needle:*
Small round, with conjunctival sutures as in Strabotomy.

(*c*) *Sterile Goods:*
(1) Pressure pad to stop oozing—special cut.
(2) Two flat pads of cotton, diameter $2\frac{1}{2}$ inches, moistened in boric acid (2 per cent.) to lay in the vacant socket—then dry absorbent cotton.
(3) Special eye bandage and mask.
(4) Cover on the good eye.

(*d*) *Notes.*—Mark carefully the eye to be enucleated.

Submucous Resection of Nasal Septum:

(*a*) *Instruments:*
Nasal speculum.
Metal applicators for the preliminary cocainization, to swab strong cocain on the mucous membrane.
Wooden applicators, previously wound with cotton *on both ends* for wiping blood from the field during operation (several dozen *sterilized* and ready for use).
Septum knife.

Elevators, of which the Freer and the Killian are the most common types (sharp and dull).
Ballenger swivel knife (two sizes).
Speculum or retractors for separating the flaps.
Forceps (various types) for removing portions of the bony and cartilaginous parts of the deflected septum.
Chisels (flat and grooved).
Mallet.
Nasal dressing forceps.
Syringe of capacity 5 c.c. if employing injection method of anesthetization.
Needles.

(*b*) *Needles:*

Septum or intranasal needles, for the insertion of sutures—silk sutures.

(*c*) *Sterile Goods:*

Gauze strips, plain.
Iodoform strips or
Dr. August Beck's rubber nasal packing bags, to prevent hemorrhage (shape of a shepherd's purse, made on the principle of the colpeurynter, or Voorhees' obstetric bags, inserted, then dilated with sterile water, stems tied).
Lubricant—K. Y. (on bags).

Adenoidectomy + Tonsillectomy:

(*a*) *Instruments:*

Mouth-gag.
Tongue depressor (metal).
Headlight.
Adenoid forceps.
Adenoid curet.
6 sponge forceps.
Long blunt scissors curved on the flat.
Tenaculum forceps.
2 tonsil snares (one on each, before snaring).
Tonsil dissecting knives (right, left).

Wires to thread snares.
Lovell tonsillar hemorrhage needle.
Tonsil-seizing forceps.
Pillar retractor.
Hemostats.
Electric suction device (prevents swallowing of blood).

Needle:

Catgut ligatures.
Extra heavy **black** silk ligatures in Lovell needle, for circular suture around oozing area.

(*c*) *Accessories:*

Crystals of
Cocain for local anesthesia,
Novocain.
Carbolic acid 1 : 20 for sharp instruments (?).
Medicine-glass (graduated).
Dropper.
Syringe.
Applicators.
Cotton.
Alcohol, 95 per cent.
Adrenalin 1 : 1000.
Bichlorid of mercury 1 : 5000.
Rubber cap.
Gown neck loose.
Rubber sheet, long and narrow to turn patient (from left shoulder out over chest, under right shoulder, and at least $\frac{1}{2}$ yard out from left shoulder again).
Waste pail with sieve to drain sponges. Towels in basin of ice and water (scant water).
Coagulometer—to test for hemophilia—to determine the rapidity of coagulation of the blood. Hemophilia is frequently unsuspected, and is the chief menace in tonsillectomy.

(*d*) *Sterile Goods:*

Laparotomy sheet, gowns, gloves.
Sterile towels, sterile water.
Numerous small sponges mounted on sponge sticks.

(*e*) *Notes:*

All tonsil cases should have two successive negative throat cultures before operation.
Protect walls and floor.
Do not throw out specimens: they prove the need of operation.
Keep patient at extreme right of table—wipe his nose frequently, to let air through, with downward stroke.
Let the air clot the vessels in the adenoid area.
Send patient on stretcher face downward, to bed, and keep so, in bed.

Incision of Pharyngeal Abscess (same method also for quinsy or peritonsillar abscess):

(*a*) *Instruments:*

Straight bistoury. Wind all the blade except first half inch of the tip, with adhesive, to prevent going in too far, on account of the great vessels in the vicinity.
Tracheotomy set—have ready, then it will not be needed.

(*b*) *Accessories:*

Pus basin—try to save and show specimen.
If patient chokes, use artificial respiration.
Hemorrhage may ensue, in which case proceed as in Adenoidectomy + Tonsillectomy. Let patient sit up in bed, against back-rest.
Turn him quickly to the diseased side, so that the pus will not cross the epiglottis.
Lights—rubber cape around patient's neck.
Back-rest and additional pillows.
Waste pail.
Mouth-wash.

Tracheotomy:

(*a*) *Instruments:*

Scalpel.
2 mouse-tooth forceps.
8 artery clamps.
1 grooved director.
1 trachea forceps.
1 trachea spreader.
Medium and small sharp retractors.
Small blunt retractor.
Curved and straight scissors.
Probe.
1 **smooth** dressing-forceps.
Needle-holder and needles.
Tracheotomy tubes, assorted sizes, with their inner tubes, and tapes.

(*b*) *Needles:*

Silkworm-gut in Hagedorn needles.

(*c*) *Accessories:*

Tie tapes under ear.
Split compress soaked in soda bicarbonate solution around tube.
One thin compress, intact, moistened with same, over.
Oiled silk bib.
Pheasant's feathers to clean permanent tube.
Remove the other very often, to clean—measure it on the feather and never put feather in any farther.
Do not tickle the trachea.
Do not expose the patient's chest and invite pneumonia.

(*d*) *Sterile Goods:*

Laparotomy sheet, gowns, gloves, towels.

(*e*) *Note.—Never boil a hard black rubber tube* (they straighten).

Breast Amputation:

(*a*) *Instruments:*

Dissecting set.
Very large number of artery clamps.
36 hemostats.
12 Ochsner.
8 Kelly.
Ligature carrier.
5 shallow retractors (rake).
Needle-holder and needles.

(*b*) *Needles:*

(1) Usually curved Hagedorn or cutting edge—may be straight Hagedorn—with silk or silkworm-gut for skin.
(2) Ligatures of plain catgut No. 1—very many—every vessel is tied off.
(3) Tension sutures (silkworm-gut) long, at choice of surgeon.

(*c*) *Accessories:*

(1) Special breast binder (Figs. 28, 29, pp. 229, 230) with a sleeve for the affected side, the sleeve being split on the upper side and fastened with tapes, to hold all axillary dressings secure.
(2) 4- or 6-inch gauze and muslin bandages.
(3) Hot saline towels on large denuded area.
(4) Be prepared for hemorrhage and shock.
(5) An additional nurse holds the arm above the patient's head.
(6) *Do not allow orderly to be present.*
(7) A very large area must be prepared for this operation (per House Rules).

(*d*) *Sterile Goods:*

(1) Large gauze pads.
(2) Cotton pads.
(3) Cotton under hand, axilla, and elbow, to support and prevent friction.

(*e*) *Drains.*—Tubes.

Aspiration; Incision; Resection of Rib (in empyema):

(*a*) *Instruments for Aspiration:*

Syringe and needles in good order (Figs. 37, 38).
Sponge forceps.

(*b*) *Accessories:*

Iodin, collodion, large graduate to measure pus (may be unsterile)—rubber sheet to protect patient and bed—assorted basins to hold pus—camel's-hair brush.

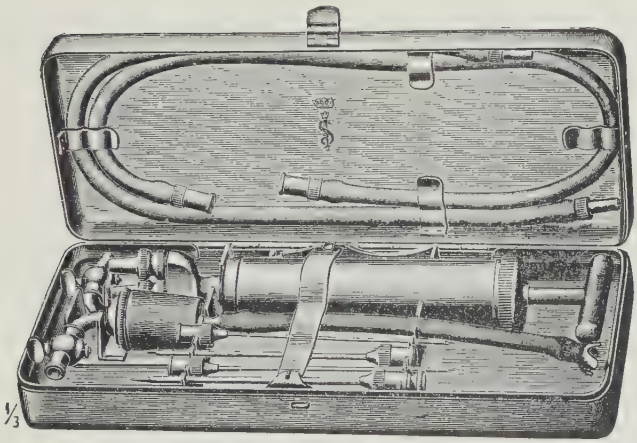


Fig. 37.—Potain's aspirator, 60 c.c.—metal barrel and metal piston, three needles, one stop-cock, one trocar, and tubing.

(*c*) *Sterile Goods:*

Cotton, gauze, towels, small glass graduate for *specimen to laboratory.*

(*d*) *Notes:*

Prepare patient posteriorly on side affected. Set a child up over a nurse's shoulder.

(*a*) *Instruments for Incision:*

Scalpel.
Hemostats.
Curved scissors.

Sharp retractors.
Mouse-tooth forceps.
Thumb forceps.
Needle-holder.
Needle.

(*b*) *Needle:*

Curved Hagedorn for skin, with silkworm-gut ligatures, catgut No. 1, plain on round needles.

Fig. 38.—Bottle for Potain's aspirator, 500 c.c.

(*c*) *Accessories:*

(1) Lay child on good side, resting her anterior chest wall on the rubber-covered pillow, bringing her arm forward so that she does not lie on it.

(2) Note change in color, respirations: point out all such data to pupils.

(3) Pus basin—small sterile graduate—large unsterile graduate.

(*d*) *Drains:*
Drainage-tubes.

(*a*) *Instruments for Resection of Rib:*
Add to set for incision:
Periosteal elevator.
Costotome (rib-cutting).
Bone hook.
1 rongeur.
1 costal raspatory.
1 bone-cutting forceps.
Safety-pins for drains.

(*b*) *Accessories:*
(1) Rubber dam—before applying it, use
(2) Unguentin or boralid to smear skin.
(3) Bottles to blow water to and fro, for chest expansion.

(*c*) *Drains:*
Drainage-tubes—empyema button (spool).
Politzer bag and tube, as of oxygen tank, the latter to produce vacuum and extract pus.

(*d*) *Sterile Goods:*
Pads, towels, sponges, sheet, gowns, gloves, etc.

Appendectomy.—Take as simplest of models for any laparotomy.

(*a*) *Instruments:*
Scalpel.
Mouse-tooth forceps.
Plain forceps.
Artery forceps.
Sponge-holders.
Retractors (small, also deep narrow pair).
Needle-holder.
Safety-pins for drains.
Intestinal forceps (Fig. 39) to grasp colon (rubber tips).
Ligature carrier.
Scissors, curved and straight.

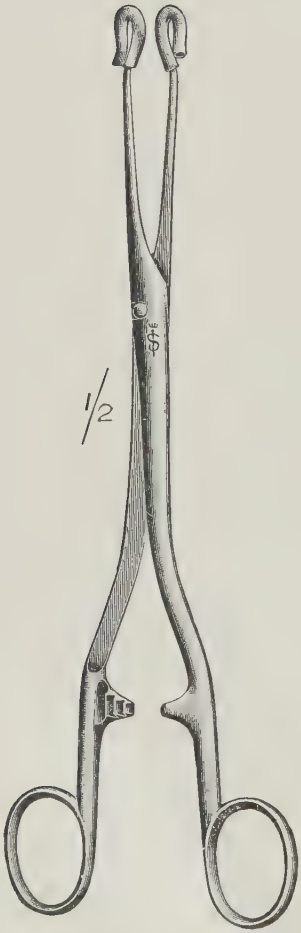


Fig. 39.—Viscera forceps. Method of covering jaws with rubber tubes.

Fig. 40.

Fig. 41.

Figs. 40, 41. — Michel's suture clips and forceps.

Probe.
Towel clamps.
Needles.

(*b*) *Needles:*

(1) Small round with plain catgut No. 1 for peritoneum.
(2) Stout short round with chromic gut No. 2 for muscle.
(3) Straight cambric, or fine round intestinal needle, with fine silk for purse-string suture to invaginate the stump.
(4) Long, heavy curved needles for through-and-through outer sutures, especially if around drainage-tubes, or
(5) Michel clips with special forceps (Figs. 40, 41).
(6) If patient is a child, use smaller needles and suture material.
(7) Ligatures, of plain catgut No. 1, for abdominal wall, and chromic catgut No. 2, to ligate appendix.

(*c*) *Accessories:*

(1) Specimen dish.
(2) Carbolic acid and alcohol to cauterize stump, or
(3) Paquelin cautery.
(4) Saline.
(5) Outfit for lavage.
(6) Equipment to take culture for pus (sterile tube, applicators, slides).
(7) Adhesive.

(*d*) *Drains:*

Drainage-tubes.

Cigarette drains—cut very simply from rubber sheet and handed in the bite of a sponge stick to the assistant who may or may not wind it with gauze.

(*e*) *Sterile Goods:*

(1) Split compress,
(2) Iodoform strip to cover wound.
(3) Rolled gauze to wall off.

(4) Tape sponges, or 1 long roll fed from pocket in sheet (no counting) (Fig. 25, p. 214).
(5) Gowns, gloves, 3 table sheets (stands, tables):
1 large laparotomy sheet.
1 small laparotomy sheet.
Packages of tape sponges.
Packages of small sponges.

Cholecystectomy, Cholecystotomy, Choledochotomy:

(*a*) *Instruments:*
Dissecting set.
Long stout gall-stone probes.
Gall-stone spoons (Fig. 42).
2 gall-stone forceps (with rubber tubing, fine para, to cover).
Gall-bladder clamp (with rubber tubing).
4 Allis forceps.
Long sounds.
Artery clamps.
Aspirating syringe and needles, or
Trocar and cannula.
Sponge forceps.
Scissors, blunt, curved, straight.
2 large kidney retractors.
Needle-holders, two sizes, with needles.

(*b*) *Needles:*
(1) Small round body, full curved, for deep work on gall-bladder, with fine silk.
(2) As in appendectomy.
(3) Small hemostatic needle, in opening duct, with silk.

(*c*) *Accessories:*
(1) Cautery, carbolic acid, and alcohol.
(2) Specimen dish.
(3) Rubber tissue apron.
(4) Adhesive in large quantities (allow for distention).

Fig. 42.—Mayo's double-ended gall-stone scoop.

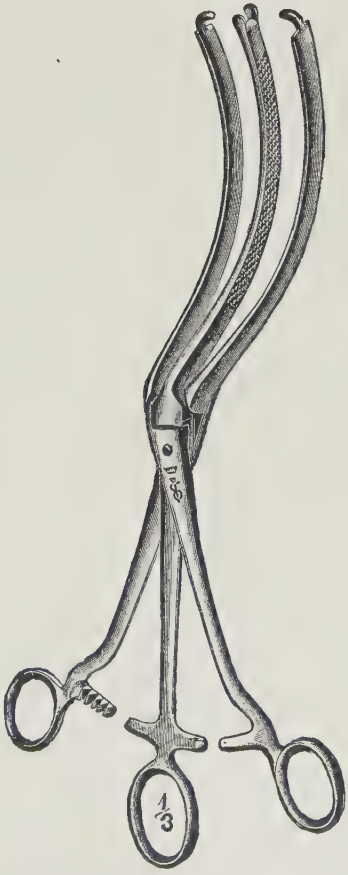


Fig. 43.—Gastro-enterostomy forceps —three blades, 13½ inches.

(*d*) *Drains:* Drainage-tubes.
(*e*) *Sterile Goods:*
(1) Sterile pus basin.
(2) Packing, plain gauze, 2 widths.
(3) Gauze to wall off.
(4) Tape and small sponges.
(5) Iodoform to cover incision.

Gastrostomy, Gastro-enterostomy, Gastrectomy, etc.:

(*a*) *Instruments:*
Dissecting set.
Retractors larger than in Appendectomy.
Sponge forceps.
Artery clamps.
Ligature carrier.
Scissors, curved and straight.
2 stomach clamps (Fig. 43).
2 intestinal clamps.
Towel clamps.
Needle-holder.
Needles.

(*b*) *Needles:*
(1) Straight needles (cambric) for fine silk.
(2) Small round body intestinal needles with No. 1 plain for peritoneum.
(3) Ligatures, chromic, Nos. 2 and 3.

(*c*) *Accessories:*
(1) Outfit for lavage—tube, pus basin, pail, pitcher of tepid water, rubber cape.
(2) Saline.
(3) Adhesive.

(*d*) *Drains:* Drainage-tubes, p. r. n.

(*e*) *Sterile Goods:* Cotton pads, fluffed gauze, tape sponges, gauze rolls to wall off; plain gauze packing, small sponges.

(*f*) *Notes:*
Live finely corrugated black pararubber tubes are boiled in a piece of muslin in a bunch by themselves, with the instruments, and

then drawn on the ends of all intestinal clamps. *These rubbers must be counted* before operation and before suturing, lest one be left in the patient. The delicate structure of the intestine can be fatally injured by metal corrugations.

Hysterectomy:

(*a*) *Instruments:*

Dissecting set.
Retractors, three sizes, including large suprapubic and self-retaining mechanical, which are screwed open, to save employing a person.
6 sponge forceps.
Artery clamps, 6 long straight, 6 long curved, 12 small.
2 aneurysm needles, right and left (Fig. 44).
1 bladder sound (to mark the top of the bladder).
1 uterine dressing forceps to draw down drain (thrust into vagina by nurse with glove).
Vulsella, extra strong (Fig. 45).
Aspirating syringe and needles (when indicated).
Pedicle clamps.
Blunt straight scissors.
Blunt scissors curved on the flat.
Sharp scissors (straight and curved).
Needle-holder.
Needles.

(*b*) *Needles:* Same as in Appendectomy—sutures for peritoneum, fascia, through-and-through, skin, intra-abdominal, intestinal ligatures—braided silk for pedicle—plain catgut No. 2 for adhesions—plain catgut, No. 4, for broad ligaments—linen or silk ligatures.

(*c*) *Accessories:*

(1) Trendelenburg—provide many footstools, graded in height and length. Be prepared for collapse of patient.

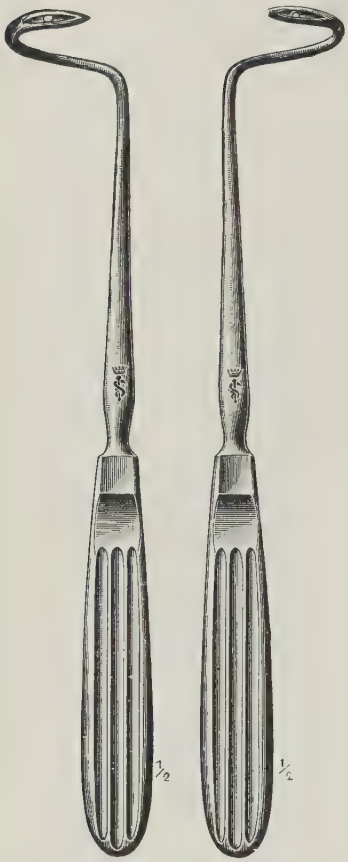


Fig. 44.—Aneurysm needles, right and left.

Fig. 45.—Vulsellum forceps (double tenaculum).

(2) Cautery.
(3) Carbolic acid and alcohol for cauterization of stump.
(4) Extra glove for nurse (guiding packing in special cases).

(5) Hot saline constantly.
(6) Adhesive.

(*d*) *Sterile Goods:*

(1) Sponges, gauze packing, tape sponges, gauze roll to wall off, or long roll fed from pocket in laparotomy sheet as in Appendectomy.
(2) Infusion set.

Cesarean Section:

(*a*) *Instruments for Mother:*

Dissecting set.
2 large clamps for the cord.
2 aneurysm needles.
Scissors, straight and curved.
Sponge forceps, very many.
Needle-holder.
Needles.

(*b*) *Needles for Mother:*

(1) Half-curved, with sutures of heavy silk.
(2) Full-curved, with fine silk.
(3) Usual for peritoneum.

(*c*) *Accessories for Mother:*

(1) Stout Esmarch rubber tourniquet.
(2) Placenta basin.
(3) Large floor basins—copious drainage of amniotic fluid.
(4) Hot saline constant.
(5) Adhesive.

(*d*) *Sterile Goods for Mother:*

(1) Small sponges, many—tape sponges, many.
(2) Gauze to wall off.
(3) Dressings.

(*e*) *Notes:*

Be prepared for hysterectomy or ligation of fallopian tubes (when legally indicated).

(*a*) *Instruments for Infant:* Extra physician's and nurse's sets. Cord instruments.

(*b*) *Accessories for Infant:*

(1) Reception blanket and basket.
(2) Hot and cold tubs.
(3) Eye solutions.
(4) Hot-water bottle.
(5) Pulmotor.
(6) Oxygen tank and intranasal catheter.

(*c*) *Sterile Goods for Infant:*

Cord tape and binder.
Blow-outs.
Mouth-wipes.

Herniotomy.—Regarded as equally important as bone-plating in rigidity of asepsis.

Fig. 46.—Hernia knife.

(*a*) *Instruments:*

Dissecting set.
Hernia knife (Fig. 46).
2 sharp four-pronged retractors.
2 blunt hooks.
Artery clamps.
Aneurysm needle.
Kocher sound.
Blunt dissector.
Needle-holder.
Needles.

(*b*) *Needles:*

(1) Medium-sized, sharp, half-curved with *kangaroo tendon* for deepest work (split sinew of tail of kangaroo)—expensive—keeps tensile strength throughout sterilization.
(2) For sac, plain catgut No. 2 in medium-sized, full-curved needle.
(3) For skin, silk or silk gut.
(4) Ligatures of catgut Nos. 2 and 3 plain.

(*c*) *Accessories:*

(1) Rubber tissue or oiled silk to protect dressing.

(2) Spica bandage, 6 inches:

(*a*) Gauze,

(*b*) Muslin.

With oiled silk cuffs and adhesive for inguinal and femoral.

(3) Hot saline.

(4) Sand-bags are used for immobilization instead of spica.

(*d*) *Sterile Goods:*

(1) Towels, tape sponges, large gauze fluffs, small sponges.

(2) A piece of sterile tape, 10 inches long, to slip under the cord as a retractor.

Nephrectomy (Lumbar Route), **Nephrotomy:**

(*a*) *Instruments* (cannot be placed on this laparotomy sheet):

Dissecting set.
Ligature carrier.
Clamps.
Aspirating syringe and needles (longest and largest).
Sponge-holders.
Set for rib resection (costotome, bone hook, periosteal elevator).
Needle-holder.
Needles.
Towel clamps.

(*b*) *Needles:*

(1) Heavy full-curved needles with silkworm-gut for outer wound.

(2) Catgut No. 2 plain for skin.

(3) Chromic gut No. 2 for muscles.

(4) Long, sharp, full-curved needles with catgut No. 3 plain.

(5) Small, half-curved needles for pelvis of kidney, with plain catgut No. 2.
(6) Ligatures of heavy twisted silk, or plain catgut No. 4, rubber.

(*c*) *Accessories:*
(1) Kidney bag—inflated, diseased kidney the higher—bag under loin of sick side.
(2) Pillow—arms in comfortable position, to prevent paralysis—patient on abdomen. *Nurses should be put in this position themselves to get fine details.*
(3) Footstools for all participants.

(*d*) *Sterile Goods:* Compresses, 4 x 16 inches, and from four to eight thicknesses. Usual sponges, gauze to wall off, etc., gowns, towels, etc.

(*e*) *Drains:*
(1) 2 red rubber drainage-tubes, $\frac{1}{2}$ x 8 inches, with safety-pins.
(2) Narrow gauze strips.

(*f*) *Notes:*
(1) To "deliver" the kidney means to bring it out through the cut with a "gush."
(2) **Be sure that the operation is on the sick kidney.**

Curetage—simple model for all lithotomy work. (For legal data see chapter on Superintendent.)

(*a*) *Instruments:*
Sims' and weighted specula.
2 vulsellum forceps.
2 tenacula.
1 small and 1 large Goodell's dilator.
Straight and curved scissors.
1 dull intra-uterine curet.
1 sharp intra-uterine curet.
1 placenta forceps.
3 hemostats.
Uterine sounds and probes.

Uterine dressing forceps.
Packer.
Sponge forceps.
Anatomic forceps.
Intra-uterine douche tip.

(*b*) *Accessories:*

(1) Kelly pad (requires very thorough disinfection).
(2) Rubber tubing for douche—can, plain water, 120° F.
(3) Safety-pins, T-binder.
(4) Stirrups.

(*c*) *Sterile Goods:*

(1) Pads, sponges, towels, gowns, sheets, gloves.
(2) Vaginal sheet and triangles (Fig. 30, p. 232).
(3) 2 iodoform strips 1 inch wide—packing.
1 iodoform strip 3 inches wide.

Test for Patency of Fallopian Tubes (Rubin's Technic).—By permission of the author of "Sterility and Conception," Dr. Charles Gardner Child, Jr., these notes have been taken and inserted here.

Intra-uterine injection of oxygen:

(*a*) *Instruments:*

Metal cannula (Keyes-Ultzmann type) perforated at tip by several small apertures.
Rubber urethral tip.
1 tenaculum (bullet) forceps.
1 uterine sound.
1 dressing forceps.
1 bivalve vaginal speculum (Graves).
An oxygen tank connected with a water bottle and gage.
Mercurial manometer.
Fluoroscope.
x-Ray plates for roentgenograms.

(*b*) *Accessories:*

Iodin, sponges.

(*c*) *Notes:*

Rubber stopper of oxygen bottle has three openings, through which pass three bent glass tubes. Bottle contains hot boiled water or mild antiseptic solution.

(1) Glass tube leading to oxygen tank dips below water level.

(2) 2 glass tubes not connected with tank dip 1 to 2 inches, but not into water.

(3) One of the latter is connected by rubber tubing to mercurial manometer and one to the metal cannula.

Volume of oxygen released determined by separate bubbles (300 to minute)—then regulate to displace 200 to 250 c.c. water per minute.

Maintain same rate in intra-uterine injection.

Test for tightness of all connections.

Trachelorrhaphy:

(*a*) *Instruments:*

Add to Curetage.
2 scalpels.
1 long pair mouse-tooth forceps.
1 probe.
1 grooved director.
1 tenaculum.
6 Ochsner and 6 Kelly clamps.
12 hemostats.
2 pairs sharp scissors curved on the flat.
1 pair dissecting scissors.
1 perineal retractor.
Wire scissors, shield, "counterpresser," wire twister.
Needle-holder.
Needles.

(*b*) *Needles:*

(1) Cervix needles with chromic gut, Nos. 2 and 3.

(2) Silver wire—five sutures—metallic silver itself is antiseptic through oxidation.

(*c*) *Sterile Goods:* Sponges, pads, etc.

Perineorrhaphy:

(*a*) *Instruments:*

Add to Trachelorrhaphy:
Kelly's crooks (as retractors).
3 vulsella.

(*b*) *Needles:* Special perineal needles—silk gut, chromic gut, Nos. 2 and 3, or button, shot, or silver wire, and silk to carry it on account of severe strain during defecation.

(*c*) *Accessories:* Antiseptic powder.

(*d*) *Sterile Goods:* Gauze packing—plain strip, for vagina.

Hemorrhoidectomy, Ligation, Local Anesthesia:

(*a*) *Instruments:*

Dissecting set.
Brinkerhoff's slide rectal speculum.
Headlight or droplight.
Pratt's bivalve speculum (to deliver hemorrhoidal tumors).
4 Halsted curved hemostats, 5 inches (to bite "spurters" or pull down tumors).
1 pair scissors, blunt, curved on the flat, 6 inches (to dissect tumors back to their base).
1 single-toothed tissue forceps, 7 inches (to remove "tabs").
Sponge forceps.

(*b*) *Ligatures:* Catgut, or tank package, twisted silk, Size 13.

(*c*) *Accessories:* Three 25-minim hypodermic syringes of 2 per cent. cocain or novocain, with 5 drops of adrenalin chlorid (1 : 1000) added to each.

(*d*) *Sterile Goods:* Sponges, wipes, rectal pads T-binder (for M. or F.) cotton, gauze, "whistle" (tampon cannula), made previously of rubber tubing wound with gauze and *copiously lubricated on every layer.*

(*e*) *Notes:* Sims' position.
Nurse or orderly on side farthest from doctor holds patient's buttocks apart, and sponges.
Hypo. of quinin and urea hydrochlorid at termination of operation.

Hemorrhoidectomy, Clamp and Cautery:

(*a*) *Instruments:*
Scalpel.
Speculum.
Hemorrhoidal clamp.
Mouse-tooth forceps.
Artery forceps.
Blunt dissecting scissors.
Scissors curved on the flat.
Special "screw-crusher" clamp.
Sponge forceps.
Needle-holder.
Needles.

(*b*) *Needles:*
(1) Large surgical, with plain catgut No. 3 to transfix large hemorrhoids.
(2) Straight needle for small ones.
(3) Catgut ligatures, No. 2 plain catgut.

(*c*) *Accessories:*
(1) Iodoform or aristol powder.
(2) Binders.
(3) Vaselin or K. Y.
(4) Soapsuds, followed by saline, for cleansing.
(5) Rubber apron.
(6) Cautery and 3 cautery tips.

(*d*) *Sterile Goods:*
(1) Towel for cautery handle—sponges.
(2) Sponge on string to plug rectum during work.
(3) Short-sleeved gown for operator—towels, gloves, etc.
(4) Tampon cannula or "whistle" well lubricated.

(*e*) *Notes:* Sims' position.
Prepare for certain surgeons hypo. of quinin and urea at termination of operation as anodyne when out of anesthetic.

Operation to Relieve Fistula in Ano—Local Anesthesia:

(*a*) *Instruments:*
1 straight sharp-pointed scalpel.
1 curved sharp-pointed scalpel.
1 straight probe-pointed scalpel.
1 curved probe-pointed scalpel.
Probes, flexible and plated.
Grooved directors, flexible and plated.
1 probe-pointed grooved director.
1 Wilm's plated angular director.
1 Brinkerhoff slide speculum.
4 Halsted hemostats.
1 single-toothed tissue forceps, 7 inches.
1 pair scissors, sharp straight, 10 inches.
1 pair curved sharp scissors, 10 inches.
1 pair Allingham's rectal fistula scissors.
2 bone curets.

(*b*) *Ligatures for Bleeders.*

(*c*) *Accessories:* 3 hypo. syringes for local anesthesia as in Hemorrhoidectomy, ligature, local anesthetic; also binder, lubricant, etc.

(*d*) *Sterile Goods:* Gauze, cotton, pads.

Operation to Relieve Fissure in Ano:

(*a*) *Instruments:*
Dissecting set.
Rectal speculum.

(*b*) Usual accessories of rectal work.

Circumcision:

(*a*) *Instruments:*
Dissecting set.
2 Kelly clamps.
6 retractors (small special).
1 special circumcision clamp.
Needle-holder.
Needle.

(*b*) *Needle:* Smallest round body with plain catgut No. 00, or silk.

(*c*) *Accessories:*
Sterile lubricant.
Boric acid solutions.

(*d*) *Sterile Goods:* Sterile bandage, to tie snugly outside of first well lubricated dressing (tourniquet) —tip exposed—gauze.

Internal Urethrotomy:

(*a*) *Instruments:*
2 or 3 urethrotomes (Maisonneuve, Otis, Maisonneuve-Fluhrer).
1 straight blunt bistoury.
1 Gouley's beaked knife.
Filiforms.
Large hand syringe and catheter.
No. 28 to 30 French steel sounds.

(*b*) *Accessories:*
Soap, pitcher.
Opium suppositories.
Boric acid, warm.
Stirrups.

(*c*) *Sterile Goods:* Water, sheets, towels, sponges, fluffs, gloves, etc.

External Urethrotomy:

(*a*) *Instruments:*
Hand syringe and catheter (to fill bladder—walls must not be allowed to collapse).
Tunneled sound, full-sized.
Scalpel.
Perineal tube No. 30 to 35 French.
Clamps.
Gorget, or probe-pointed director.
Needle-holder.
Needle.

(*b*) *Needle:* Silk suture through perineal tube, and edges of wound on round-bodied needle.

(*c*) *Accessories:*

Kelly pad.

Boric acid or saline, warm, T-binder, split (M.), opium suppository, bottle of bichlorid of mercury 1 : 1000 under bed.

(*d*) *Sterile Goods:* Fluffs of gauze, sponges, gloves, gowns, towels.

Prostatectomy, Suprapubic (enucleation for hypertrophy of gland):

(*a*) *Instruments:*

Dissecting set.

Syringe and stiff gum catheter—wash out bladder at first and last—test for free drainage before closing.

Scoop (to remove calculi).

Artery clamp—Kelly and other strong forceps.

Sponge forceps.

Needle-holder.

All stimulation sets.

(*b*) *Needles:* Silkworm-gut sutures, deep into recti muscles on round needle. No sutures in bladder.

(*c*) *Accessories:* Hot boric acid to irrigate for hemorrhage (only 2 mins.).

Thermometer, all glass.

Kelly pad and stirrups.

(*d*) *Drains:* Rubber tubes, $\frac{7}{8}$ inch in diameter and 5 inches long with large openings on sides, in bladder gauze wick in wound, outside of bladder.

(*e*) *Sterile Goods:* Gowns, gloves, sheets, many sponges, triangles.

Amputation of Leg:

(*a*) *Instruments:*

Dissecting set.

1 curet.

1 periosteum elevator.

1 sequestrum forceps.

1 rongeur.

1 large bone-cutting forceps.
1 large saw.
1 rubber tourniquet.
1 needle holder with needles.
1 amputation knife.

(*b*) *Needles*, etc., as usual.

Bone Work in Osteomyelitis:

(*a*) *Instruments:*

Dissecting set.
1 mallet.
3 chisels, assorted sizes.
1 gouge.
1 periosteum elevator.
1 pair bone-cutting forceps.
1 sequestrum forceps.
4 rake retractors.
1 bone curet.

(*b*) *Accessories* as usual.

General Addenda:

1. Commonest needles, Martin and Mayo.

2. Select needles carefully before operation and boil in gauze or perforated metal needle box—then dry and lay loose under towel.

3. Trocar and cannula should be boiled together—rubber tube added *after boiling*.

4. Cautery requires special intelligent care—always in commission—tips protected in soft box—smooth, polished after each case.

5. Iodized catgut must be kept in a dehydrated container, as deterioration keeps pace with the degree of moisture.

6. Forty-day chromic gut is apt to cause irritation or "catgut indigestion" with serous exudate, sloughing of the knot, and fright to surgeon and patient. It may be lack of absorption only.

7. *Honesty is an absolute term, not relative*, when applied to the processes through which catgut passes in a nurse's hands.

8. In bone work forty-day chromic gut is a resistant but absorbable material.

9. In secondary perineal repair forty-day chromic gut resists absorption for not more than ten to twelve days, hence silk gut is better.

10. Sutures and ligatures must be covered with a dry sterile towel after being opened and threaded, then moistened swiftly before handing to the surgeon.

11. If moistened too much, catgut loses 50 per cent. of its tensile strength.

12. Do not be too generous in making catgut ready.

13. Formol, trioxymethylene, and paraform, generated in special cabinets, are good for genito-urinary instruments; but it is more essential to have them smooth, bright, and to handle them gently than to sterilize them for an already infected area.

14. Dip them in sterile boric acid as a lubricant.

15. Sounds are in bags with sections (as flat silver is kept).

16. Wash with soap and water, dry on sterile gauze, wet with alcohol, and let it burn off, or boil in 2 per cent. washing soda solution or plain water; cool with cold sterile water.

17. The tunnel in a sound must be cleaned well with a stiff nail-brush, soap, and water.

18. Hard-rubber tubes must not be boiled.

19. Olivary bougies are not boiled—lay away straight, in compartments.

20. Whalebone must be kept straight; oil, keep dry in metal box, no boiling.

21. Blade of urethrotome never heated—set in alcohol.

22. Woven catheters—cleanse with hot water and soap —cool and dry—lay away straight and separate.

23. Soft catheters—buy the best—test for elasticity—discard when lifeless (they may come apart in the patient).

24. Ureteral catheters with stylets—wash in soap and water—let water drain through (mistake might make a diagnosis with fatal significance to wrong patient)—

hang in formalin cabinet—wet with sterile boric acid before using.

25. Cystoscopes—wash—run alcohol through—dry—hang in formalin cabinet. Dip in cool boric acid before using.

26. Lubrication by lubrichondrin is most safe and smooth. Olive oil can be syringed into cavities.

Emergency Sets:

These are put up and labeled in order to hasten relief for a patient, in night emergencies, or other instances in which the operating-room staff is at its minimum. They contain sheets, towels, instruments, *et al.*, and shorten splendidly the time and labor required. They meet the demand for:

(1) Secondary hemorrhage from tonsils or other nose and throat work.
(2) Tracheotomy.
(3) Ear cases, excision of part of jugular vein in thrombosis of lateral sinus.
(4) Transfusion.
(5) Intravenous infusion (bottles included).
(6) Hypodermoclysis.
(7) Aspiration.
(8) Evacuation of free fluid in abdomen, following ruptured gastric ulcer or appendix, or of a cyst.

CHAPTER XVIII

MINOR WORK IN THE OPERATING ROOM

Intravenous Infusion—Gravity Method:

(*a*) *Instruments* (same as for hypodermoclysis)—put away sterile:

Scalpel, freely curved edge.
Grooved director.
Probe.
Forceps, plain.
Forceps, mouse-tooth (not on vein).
Artery clamps.
Curved scissors.
Cannula of silver only.
Needle-holder.
Needle—curved or straight Hagedorn, with plain catgut No. 1 in tube.
Glass connecting tube.
Fine rubber tubing (never cut a catheter to fit a cannula).

To put these up, boil, dry with aseptic precautions, and label, so that they may be used also, if necessary, for *phlebotomy*. Nurse putting them up signs label. Dry dressing sterilizer might rust instruments.

(*b*) *Jar and remainder of equipment*—as for hypodermoclysis—put away sterile.

Irrigating jar, tubing and tape—numbering 0 at the top.
Cut-off.
Dairy thermometer (all glass) in solution.
Infusion thermometer in tubing at proximal end (showing temperature at delivery).
2 pieces of large rubber tubing (one long, one short).

These bundles must always be kept in the same place, to avoid confusion in emergencies.

(*c*) *Accessories:*

Infusion stand.
Table for the arm.
Tourniquet (Esmarch).
Sponge pail.
Asbestos mat.
Sponge stick.

(*d*) *Sterile Goods:* Towels, flat gauze sponges, 2-inch gauze bandage, caps, gloves, aristol, hot and cold sterile water and pitcher, saline flasks, iodin $2\frac{1}{2}$ per cent. ($\frac{1}{4}$ tincture, $\frac{3}{4}$ alcohol). These can be assembled on any well-managed ward.

Remarks.—Intravenous infusions are not always managed successfully. There are *never any two same persons* present in the various groups giving it in any hospital. People do not work smoothly together the first time, particularly in such a crisis. The remedy is DRILL BEFOREHAND. The nurse when on probation, giving baths, is preparing for this, by closely observing the size and position of the superficial blood-vessels, in arm or ankle. There have been so many unhappy traditions about infusion sets, aspirators, and cauteries that sometimes a doctor evinces mild surprise when an infusion goes well.

There should be two sets for the smallest hospital, (*a*) In case two patients needed it, or (*b*) if parts are lost, or (*c*) if parts are being replated, or (*d*) if a patient is in isolation. They should be opened at regular intervals to see that all is in order and rustless, then resterilized. This is not a *waste of energy*. The instruments are to be of the best, not discards.

The old vexed question of temperature has been solved by the infusion thermometer, registering from 90° to 104° F., fixed inside a glass cylinder as a connecting tube. This is inserted in the pipe near the wound, or point of

delivery. The solution in the tank is usually kept at about 120° F., so that when it passes through 4 feet of tubing, cooled by the surrounding air (which is 70° F.), it will be delivered at 100° F. Too high a temperature causes sloughing.

The jar shaped like an inverted cone is most satisfactory, and the speed can be controlled by pinching the tube, to prevent acute dilatation of the heart. Do not be tempted to raise the jar high, so as to get through quickly. The bottom of the jar is *one foot only* above the patient's heart.

Nursing.—The pulse, respiration, skin, perspiration, color, finger-tips, body temperature (hand), faculties must be carefully scrutinized. When showing sound return to normal the treatment is stopped.

Fig. 47.—Meinecke infusion and irrigating thermometer.

Arithmetic.—The nurse must give the statements about the quantity of saline thrown in from time to time. When about to pour in, pinch the tube and note how much is in the jar. Then pour in and note how much. If it were standing at 750 c.c. (near bottom), and we raised it to 150 c.c. (near top) we really added 600 c.c. (750—150). Add new before the first gets below the lowest mark:

(*a*) So that we can estimate it exactly.

(*b*) To let no air into the vein.

Adding.—When putting solutions in jar, cool first, then hot. When wishing to heat, add hotter saline *very slowly*, watching upper thermometer. Pinch the tube till these temperatures are adjusted.

Infusions are given after a hemorrhage, *after* the bleeding vessels have been tied off. It is exactly like priming a pump that has gone dry. Normal saline contains as

much salt as the blood, and if thrown in to prime the heart and give it something to do, the patient can manufacture more blood in a day or two. (See Anastomosis in any Anatomy text-book.)

The tourniquet is put on the upper third of the humerus, between the heart and the seat of incision. The usual incision is in the median basilic vein.

Saline for infusions is made up triple strength, that is, 3 drams to 1 pint, so that the very hot salt may be the proper strength when diluted with cold sterile water. It requires less space for storage also. It must be labeled "infusions—triple strength," to avoid mistakes, in an age of hurry and insincerity. Nurses desiring this for ward use must not help themselves. An operating-room nurse gives it out. At night the night supervisor is responsible, reporting where the goods went.

Hypodermoclysis:

(*a*) *Instruments:* Put up sterile and labeled:
Two needles with stylets (all in good condition, dried, lubricated, sizes assorted).
Two pieces of fine rubber tubing to fit them.
One glass Y.

(*b*) *Jar*, as in Intravenous Infusion.

(*c*) *Accessories*, as in Intravenous Infusion, with collodion and cotton.

Remarks:

(1) Do not put hot flasks on glass table tops.
(2) Set up a sterile table with disinfected dressing forceps to handle goods.
(3) When pouring into the jar, hold the pitcher an inch away from it.
(4) Nurse prepares patient:
Arms above head,
Gown drawn up to chin and tucked tightly under shoulders,
Face shaded by towel,
Sterile towels across chest and abdomen above and below nipple line.

(5) Nurse manipulates the cut-off till temperature is 100° to 102° F.
(6) Nurse notes amounts, replenishes, takes pulse, scrutinizes patient.
(7) Usual amount 1000 to 1500 c.c.
(8) Surgeon massages fluid into remoter tissues.
(9) Packages must be put up by operating-room nurses only—ward nurse simply boils and cleans them.
(10) Boiling in a towel keeps scum off.

INJECTION OF BLOOD-SERUM

In certain conditions of (1) hemorrhages of the newborn, (2) traumatic hemorrhages, (3) hemorrhages after operations, and (4) purpura hæmorrhagica (early) the loss to the general circulation is sometimes restored by the injection of blood-serum. As in transfusion, the blood of a very near relative by consanguinity—that is, one's own parent or a descendant of the same parents as one's self—must be obtained. For a newborn infant the father, and for a newly delivered woman her father, mother, brother, or sister. The blood from the donor is withdrawn, set in the ice-box in a sterile open-mouthed vessel, but covered, to permit taking out the clots easily after they form, yet let nothing unclean drop in. In twenty-four hours, when the coagulable matter has collected into one clot, the serum, now absolutely clear and slightly heated to body temperature by standing in tepid water, is injected by a large ground-glass syringe in doses of 15 to 25 c.c. in the patient's buttocks. As a rule the second treatment is the last. In all these cases the donor shows marked effects: (*a*) Bluish patches under the eyes, which are sunken; (*b*) general lassitude; (*c*) great disturbance of the heat centers, heat sensations rapidly and irregularly alternating with cold, *showing* that he must be put to bed until his circulation is readjusted. The injection is performed with strict asepsis.

Transfusion.—The method of transfusing has changed greatly recently, and the scope of its use broadened. Needles reduce the danger of infection, a vital point, as blood is a fine medium for the growth of bacteria. There are two great difficulties in the way of transfusion:

(1) Any of the blood may clot rapidly and cause a thrombus.

(2) It is hard to find compatible blood.

Professional donors are listed in large cities, each with his serum typed. "One whose blood will suit all cases is called a universal donor." Citrate has been used as an anticoagulant (to prevent clotting), but its chemical action destroyed some qualities of the blood, and caused such reactions as malaise and chills in the patient. Brines now uses whole blood, unmodified, with better results.

Nurses must be careful in the use of this term, as distinguished from infusion, in which

(*a*) The solution is saline.

(*b*) There is only one person treated.

(*c*) There are no coagulation tests needed.

Transfusion, on the other hand, transfers blood warm from one person to another, lying side by side. The accurate diagnosis of ectopic pregnancy, followed by aspiration of the free blood in the peritoneal cavity, and transfusion to the same patient has been performed successfully by a surgeon in Washington. It is indicated in the following cases: gastric and duodenal ulcer, typhoid, ectopic pregnancy, hemorrhage in tonsillectomy, advanced purpura hæmorrhagica, hemophilia, carbon monoxid poisoning.

The patient could be killed with kindness if the blood of the donor (preferably a blood relation, mother, father, sister, brother, son, or daughter) does not correspond in the coagulation test. The blood of a cat, injected into a human being, causes death probably after the first, positively after the second, by hemolysis. Vice versa, if a man's blood were injected into a cat, the latter would die from blood destruction.

The Unger method is simple and quick, affording few opportunities for mishaps. Patient and donor lie on parallel tables with a board or small table of equal height between them. They face each other, but are covered. The special Unger syringes are set on the table, and after the arms are punctured, the syringe to the patient is closed while that to the donor is filling. Then the latter is closed while the fluid is propelled into the vein of the patient.

The amount is estimated by multiplying the number of cubic centimeters in one syringe by the number of times it is filled. This is recorded on the chart.

The slight wound is sealed with collodion and cotton, so that, with the usual skin preparation, there is a minimum chance for infection.

The patient's color, lips, nails, skin, pulse and respiration must be very closely watched during this brilliant and showy performance. The donor, being excited and healthy, sometimes has such a blood-pressure, that the syringe piston is pushed back by it.

Administration of Salvarsan or Neosalvarsan—Gravity method:

(*a*) *Instruments and glass, etc., to be sterilized:*

Straight artery clamp.
2 needles—special—shortest, simplest are best —with stylets.
2 cylindrical graduated tanks, holding each 300 c.c., with spouts.
2 long rubber tubes—from tanks.
Nickel-plated "dog" with 3 mouths for attachments (2 cut-offs with switch).
2 glass connecting tubes (windows) tapering points.
2 fine rubber tubes to fit "dog."
1 fine rubber tube to vein with window and metal collar, threadless, on which needle fits.
1 glass graduate to mix saline and salvarsan.
1 glass stirring rod.

(*b*) *Supplies:*

Tablets of salt (measure) for salt solution.

Ampules of salvarsan in correct dosage (or neo-salvarsan).

Distilled water.

Pitcher.

Sterile towels, sponges. Esmarch bandage, alcohol, cotton, iodin and collodion, tripod to elevate tanks.

(*c*) *Method:*

The nurse boils the set A in a pan lined with a towel, stuffing the cylinders with cotton so as to keep them free from scum.

She boils the distilled water in pitcher (measuring water with graduate), and cools it to room temperature. The physician dissolves the salt tablets in distilled water in sterile graduate, by help of glass rod, and with the "dog" shut, fills the saline tank up to about 60 c.c. The nurse then disconnects this tube, pinches it, raises it to the level of the surface of the solution in the tank, to throw back the air—and repeats this twice more, so as to be sure there is no air.

The physician, meanwhile, breaks the ampule of the drug with file, empties the contents into the graduate with the balance of the boiled water, dissolves thoroughly, and pours into the second tank. The nurse watches that the "dog" is shut while he pours in, then she expels the air (three lifts) as before. Then she expels the drug from the third or lowest tube and sees that the needles are patent.

The "dog" should have a mark on the *outlet* (leading to the vein) and always be used the same way.

To let the saline into the vein, the first step is

to throw the lever over between the saline tube and the outlet. This must be instantaneous. The nurse has to work fast, hence she needs frequent rehearsals. The doctor sterilizes the skin over a likely vein, with iodin, and then clears the field with alcohol, drying it well. Then he applies a tourniquet, which the nurse clamps. Then he punctures, and the nurse has the flow of saline already at the mouth of the tube, which he connects on the needle while she instantly releases the tourniquet cautiously, so as not to get it smeared with blood. Then she marks the amount of saline—raises the standard, and after 5 c.c. are given, throws the lever over to the other side, and watches the salvarsan disappear from tank, tube, window, etc. When it is due at the "dog," she switches back to saline to leave none of the irritant drug near the wound. When there are about 5 c.c. again given, she pinches the tube, the doctor withdraws the needle, and seals the opening. If the needle is kept out of the pan, those things not contaminated need not be boiled to put away. The patient tastes the drug in forty-five seconds. Towels must be boiled before sending to the laundry. Giving saline first shows that the needle is in the vein, and also dilutes the drug at the point we wish to keep free from callus or thickening for future punctures. The patient, if the stomach is empty, will have less nausea and malaise, though with large doses there is sure to be chill. If given about 5 P. M., he is in good condition in the morning. Specimen of urine examined regularly. This is so universally given that private nurses should learn how to assist. The stage in which

patients are should be told the nurse, the degree of infectiousness, the seat of existing lesions. Even in the poorest clinic the method should have operating-room technic. These cases are not done in an operating room.

Phlebotomy (Venesection, Blood-letting, Open and Closed Methods):

(*a*) *Instruments*—Open Method:

One scalpel.
One scissors.
One grooved director.
Two mouse-tooth forceps.
One aneurysm needle.
Four hemostats.
Catgut ligatures.
Cannula (p. r. n.).

(*b*) *Accessories:*

Iodin and alcohol.
2 pus basins to catch blood at wound.
Graduate.
Pail.
Large rubber to protect bed.
Bedside table (set to be convenient for operator).
Brush (wire and bristles).

(*c*) *Sterile Goods:* Sponges, towels, gown, gloves.

(*d*) *Notes:*

(1) The degree of fibrination must be found by whipping the blood with a special brush into clotted strings, as after postpartum hemorrhage—the weight of fibers to total measure of blood.

(2) Set table with aseptic precautions.

(3) Do not let patient see blood or stains—reassure him—watch force and frequency of pulse, before, during, and after, and chart all data.

(4) Do not allow any stream to escape unnoticed below basin, thereby depleting the patient more than is accounted for—rubber tube on cannula prevents this.

(5) This treatment is now comparatively rare, and used only in conjunction with accurate diagnostic tests with sphygmomanometer, etc. The doctor formerly was called the "leech," when all disease was supposed to be curable by blood-letting, and living leeches were applied to suck out the overplus.

Phlebotomy—Closed:

(*a*) *Instruments:*

Needle with stylet—rest as above.

(*b*) *Notes:*

(1) To relieve plethora, etc.

(2) To obtain small amount as specimen for blood-culture. Pathologist has special technic to prepare the skin, sterilize the instruments and the containers carried to the laboratory—very elaborate—should be posted in nurses' work-rooms; and arranged to suit him.

(3) *Our desire for asepsis* is to prevent bacteria from entering the patient.

His desire is to prevent any but the bacteria already supposed to be in the blood-stream to enter the specimen. He is assisting the surgeon to make a diagnosis for some febrile or septic condition.

Cystoscopy—Excessive precaution not to get specimens mixed (major in importance, but not requiring general anesthesia):

(*a*) *Instruments:*

Cystoscope.
Catheter (urethral).
Catheters (2 ureteral) and stylets.

Sponge sticks.
2 small glasses.
1 glass syringe.
2 test-tubes marked L. and R.
3 sterile bottles (4 oz.—bladder, right and left ureters) marked B. L. R.
Toothpick swabs to anesthetize meatus with cocain. (See chapter on Dressings.)
Hypodermic syringe and needle for phenolsulphonaphthalein.

(*b*) *Accessories:*

Alcohol or iodin for skin for hypo.
Tincture of green soap and water, to scrub.
K. Y. lubricant.
10 per cent. sodium hydroxid.
Cocain crystals in charts—cocain, 4 per cent., to be made up.
Ampule of phenolsulphonaphthalein and *file.*
Clock to time action of hypo.
Stirrups.
Floor basin.
Stools for operator and anesthetist.

(*c*) *Sterile Goods:*

Cotton balls, gown, sponges, triangles, vaginal sheet, towels.
Basin of bichlorid 1 : 3000.
Basin of formalin, 4 per cent.—or carbolic acid, 5 per cent., for instruments.
Basin of sterile water to rinse.
Pitcher of sterile water to irrigate bladder, with tubing and funnel or syringe.

(*d*) *Notes:*

(1) Patient is conscious—conversation and behavior should be more than ever ethical.

(2) Phenolsulphonaphthalein is given to show what length of time is required by the affected kidney to throw off anything,

i. e., to function. A normal kidney throws off the colored urine in about one hour.

Lumbar Puncture (diagnostic test—relief of cerebral pressure), injection of medication or serum:

(*a*) *Instruments:*

Lumbar puncture needles, special design, assorted sizes, with beveled stylet and an eye $\frac{1}{2}$ inch above the point.

Sterile 2-ounce glass.

Forceps.

Sterile glass graduate to contain the first flow of fluid (may be a small one).

Sterile glass graduate (large) to send whole specimen to laboratory.

(*b*) *Accessories:* Rubber sheet, pus basin, iodin, collodion, table.

(*c*) *Sterile Goods:* Cotton, sponges, towels, gown, sheets.

(*d*) *Notes:*

(1) This test is made, with operating-room technic, on the ward.

(2) It is for cerebrospinal or tubercular meningitis, and other diseases occurring in the cord.

(3) The patient must not be infected with more than he already has to fight.

(4) His specimen must not be contaminated:

(1) To show some disease he has not.

(2) To injure patients inoculated with antimeningitic (*et. al.*) serum made in the big laboratories for epidemics.

(5) The lumbar vertebræ are bowed out, by bringing the knees and chin of the patient together.

(6) The area is painted with iodin, landmarks taken, and the needle inserted.

(7) Unfortunately for the mental state of patients not unconscious with these diseases, there is no suitable local anesthetic. Those who recover recount how harrowing it is, hence, though they may be rigid and speechless, nurses and doctors must never indulge in cold, indifferent conversation or *badinage*.

Injection of Serum or Anesthetic in Spinal Cord (Stovain):

(*a*) *Instruments:*

Add to Lumbar Puncture:

(1) Special glass (gravity method) and tube—20 c.c.—graduated, taper point.

(2) Needle of above—all fit.

(3) Sterile glass into which to pour stovain from ampule, thence into (1).

(*b*) *Serum or anesthetic:* Standing in warm jacket of bichlorid of mercury 1 : 3000 at 100° F.

(*c*) *Notes:*

(1) Patient has less malaise and other reactions of uncomfortable sort if injected fluid is at body temperature (not above, as it will thicken).

(2) No air enters.

(3) No force is employed—merely *tapping*, or, as in maple trees, fluid is let run by gravity, *never propelled by a piston suction.*

(4) Stovain is a chemical substance, innocuous to a normal heart or kidneys, hence an alternative to general anesthesia.

(5) Stovain is followed by operation (often major), hence patient receives it sitting on the table.

(6) Strip him to waist of loose operating-room garb, let lean forward, resting his arms on the shoulders of a short orderly,

standing close. Spinal fluid is drawn off, and may be thrown away, on word of surgeon, at once. Tube for stovain is connected and held very low, to show presence of spinal fluid (and expel air), then the drug is added, *before raising* it to let it run in. Patient's eyes covered, his sensation is now tested, from the toes up to the site for the wound. When complete anesthesia up to the desired point is obtained, he is laid on the table, and the operation is begun. Some patients have died after this anesthetic, while for others it has seemed ideal. The anesthetic must not be blamed for the death when it may have been the operation.

Artificial Respiration:

This is positively the duty of the physician, but in case he is not to be found, or has been incapacitated in any way, a nurse should know how to perform it, just as it is done by the Life Saving Corps or by gymnasium instructors.

The Sylvester method is very satisfactory because it can be comprehended by others than physicians.

General Rules:

I. Never give up hope; keep up the treatment for at least ninety minutes.

II. Consider the patient *alive* at the start.

III. Carry out the treatment where the patient is.

IV. See that there is no obstruction in the nose or throat.

V. Do not get excited and do not give too rapidly.

VI. Elevate the patient's shoulders about 4 inches.

VII. Clamp the tongue, and let another assistant draw it forward with each expiration, and not let it drop back, ever so slightly, with each inspiration, impeding it.

VIII. Stand or kneel far enough above the patient to

have good purchase when pressing downward behind his head.

IX. Make the (inward and outward) respirations for an adult 16 to the minute—that is, $3\frac{3}{4}$ seconds each—two seconds for the inspiration and almost two seconds for the expiration.

X. (*a*) Grasp him by the forearms, half-way between elbows and wrists, and draw up his arms out and over his head steadily until the hands touch the table, floor, or ground behind his head. Hold them there for two seconds. This motion expands the chest by drawing up the ribs; air may enter. Two seconds' halt allows it plenty of time to fill the lungs completely. (*b*) Reverse that movement. Carry the arms downward until they rest against the sides of the chest, bringing the forearms in a little on top, pressing them firmly downward and inward against the chest for one second. Listen for the sound of air entering and leaving. If not heard, the work has been done incorrectly.

Other Means of Resuscitation:

(1) Cesarean section: Newborn infant:

(*a*) Hot tubs, 110° F.
Cold tubs, 70° F. } alternate sousing.

(*b*) Throwing up in air—extended at full length—one hand at back of neck, one hand at buttocks.

Bringing down with force—collapsing, drawing together—to empty lungs of mucus (like shutting a concertina).

(*c*) Blowing air into lungs, through sterile gauze rolls, moving up 6 inches of the roll each time.

(*d*) Suction apparatus.

(*e*) Dilation of rectum by speculum or fingers.

(2) Sundry other conditions.

Pulmotor.

Administration of Radium.—This powerful, costly, minute, dangerous substance requires prolonged study,

extreme care, and vigilance. It should be kept under reliable lock and key. Its power is measured as "emanations" in units called "mache" units, so many thousand per minute. A tiny portion is laid in a hollow cylinder and held in the vicinity of the lesion for which its use is prescribed, by the operator, for a specified time, then withdrawn. The cleansing, position, and draping of the patient are the same as for a corresponding operation. The work and observations of the surgeon are charted. The special technic of radium is more than the work of a lifetime and must be partially acquired by practice with experts. Visit reliable radium institutes, recognized by the great medical academies.

Forms of Stimulation in the Operating Room (not previously given):

(*a*) Coffee enema:

Black Coffee: Take 1 cup ground coffee and 1 cup cold water. Bring to boil rapidly, clear with a dash of cold water—reduce to 110° F., and give, with warmed tube, funnel, etc.

(*b*) Saline: Saline ℥iv and whisky or brandy ℥j, at 100° F.

(*c*) Elevation of feet.

(*d*) Heat in all forms.

(*e*) Hypodermic injection (see Hypodermic Injection).

Intravenous Therapy.—This form of administration of medication enjoyed a much greater fervor at one time than now, though used yet for some types of disease legitimately. The technic is as for salvarsan. There is a danger from fads, but when proper to give it, the operating room should send one of its nurses to the ward if there are none there with that training previously.

Treatment for Hemorrhage.—Primary. Secondary. In "open" hemorrhage, where it can be controlled by ligation, vessels are immediately tied off. Do not stimulate the force of the pulse while vessels are open. Treat for collapse, otherwise (air, rest, heat, elevation, pressure). Primary hemorrhage in the operating room falls to the

care of the circulating nurse, hence she must be well drilled in speedily doing the right thing. Pressure will include

Digital,
Tourniquet,
Binder,
Tonsil clamp when indicated (boil).

Elevation must include knowledge of the circulatory system. Styptics include

Very hot water, or sponges,
Cold,
Silver nitrate,
Cautery,
Adrenalin,
Stypticin.

The operation may stop and more ether be given.

Secondary hemorrhage occurs after the operation, and must be watched for after all cases, particularly tonsils, vaginal hysterectomy, and any form of childbirth. Always expect it. Never let it surprise you. Always have instruments and packing ready for every type. The surgeon will probably order morphin, if not previously given within too short a period. His work is ligation, cauterization, and packing, during which he expects the nurse to proceed automatically with all other measures. The history of every patient needing surgical care must be taken relative to hemophilia. Rehearsal of all these nursing procedures, with a dummy, at a snappy signal, is very necessary to avoid confusion, and save steps, making every act tell.

Hypodermic Injection:

Simple, aseptic, efficient.

(*a*) Required: Luer syringe and slip-on needle—frequently tested and inspected—sponge stick when iodin is used—cotton balls for alcohol—matches or pilot light—gas—ampule with file—liquid drug—tablets—basin to boil syringe—spoon—stylet in needle.

(*b*) Method: After boiling, draw up barrel of boiled water and expel all but 20 minims. Expel this into spoon

—drop tablet into spoon and stir with point of syringe till clear—draw up into barrel—slip needle on without touching shank—expel air. Carry to bedside on tray, syringe needle resting on sterile cotton—skin preparation —clean skin vigorously, pinch—hold hypo. like a pen, at 45 degrees to arm—inject—withdraw, loosen hold—stop with cotton—rub upward and retire.

(*c*) Clean-up: Rinse barrel, dry—boil needle with stylet—dry thoroughly—put away in place.

Abdominal Paracentesis:

(*a*) *Instruments:*

Trocar and stylet (beveled), suitable size.
Sponge stick.

(*b*) *Accessories:* Rubber, pail, pus basin, graduate (very large tub needed at times)—collodion—iodin.

(*c*) *Sterile Goods:* Cotton, sponges, towels.

(*d*) *Note:*

(1) This has to be done so frequently usually that great care must be taken not to injure the tissues.

(2) Specimen to laboratory only if ordered—not likely.

(3) No particles of broken glass from ampule should be in drug.

(4) Do not boil the drugs.

(5) Mercury salicylate in oil must be heated to blood heat only in a second cup, then shaken, before drawing into barrel.

(6) After oils the syringe must be thoroughly cleaned with soap and water. A small wire and bristle brush (for drinking tubes) is excellent for this purpose (and to clean inner tracheotomy tubes).

(7) The needle is slipped on, and then dipped in to the ampule which must be held by another person, and the contents drawn up. To emty into spoon is impossipble.

Avoid a large number of steps in any such process.

(8) With liquid medications, the requisite amount can be approximated and dropped into the boiled spoon, drawn up, air expelled, and measured.

(9) With stock medications of more or less than the dose ordered, the problem must be solved on paper and o. k.'d by a supervisor before giving. (See chapter on Formulæ and Directions.)

(10) Doctors and dentists have quick, simple, emergency technic which should be studied by nurses appreciatively.

CHAPTER XIX

RELATIONS BETWEEN THE SUPERINTENDENT AND THE OPERATING ROOM

To place anyone in a position higher than that of Directress of Nurses in a small hundred-or-so-bed hospital is a ticklish thing to do, since it infers finding one with more executive ability, power to please justly, and weight of judgment. Usually the best type has been a woman superintendent with nurse training, who has developed executive power outside the class-room, and to whom the public business of the institution makes a strong appeal. These women have been drawn out of the class-room, rather than rushing out and demanding higher rank. The narrow cramped life of a small institution will never appeal to a man of strong capabilities or the qualities of leadership, and if he has not those qualities, the position of business manager or financial assistant might better be subordinated to that of Directress of Nurses (or as some European hospitals name their steward "Ekonome"), who heads the nursing department, which is the primary function of all hospitals, especially as the other could really be carried on in a separate building or down town. Hence, in the field of this text-book, the term "superintendent of the hospital" infers a woman graduate nurse.

The first quality she must possess in relation to all departments, especially the one of which this is written, is to be ethical—a quality not so much in evidence as necessary, alas! Problems arise, in booking cases for the use of the room, as to the type of surgery, the hours required, where some surgeon appears to violate a staff rule. When such booking is made in the office of the Superintendent (as distinguished from the Directress of Nurses) she should confer with the Directress thereon,

who knows the limitations of the operating room, and whose other departments are greatly affected by rushing aid to it. There is no occasion for, or honorable, successful administration in, talking to under officers of the training-school. They become egotistical, and can easily develop into an institutional menace. The operating room cannot live by itself alone, and its supervisor must lean hard and often on the Directress, hence the Superintendent must confine all her dealings to the latter, and keep her fully posted. There is nothing more frequent or more deadly insidious, than the avoidance of the training-school office in all matters where graduate staff nurses or pupil nurses are concerned, by either surgeons or Superintendent. Concentration of authority in this office avoids embarrassment, friction, and waste of time. The Superintendent builds her ethics on her ideas of what is best for all her patients, according to her conscience, which ought to be a very live, quickened thing. The pay-roll for all ward workers and staff should be computed and administered by the Directress, who also appoints all.

The second quality is to be judicious. Women frequently go by inspiration, which is usually correct, but many times it cannot spring forth, when they must then jot down what is required and reason out the step to take. The wisdom of others may be drawn upon. What is most necessary must be done first. What is needed by the greatest number should be bought first. That surgeon who succeeds in getting the ear of the Superintendent may induce her to buy a cautery, which he rarely and nobody else uses, whereas a few more artery clamps are greatly missed. To be judicious is not to deplete the budget by personal influence, but to refer such purchases to the proper committee composed entirely of surgeons.

The third quality is regularity of hours on duty. To be lax about time creates not unjust jealousy. The hospital should receive a full day's work every day that it is legitimate to have. Making rounds daily, at a suitable hour to confer with heads of departments, accom-

panied by the Directress when suitable, as in the operating room, trains the workers in systematic review of their field before the surgeons come, or the habit of severe self-appraisal, so often confounded now with pleased self-praise; also, lists of repairs for steam-fitter, plumber, etc., should go in very early.

Fourth, a Superintendent must be fair, impartial, always weighing statements, saying nothing till sure, leaving no stone unturned in investigations. The swollen self-aggrandizement of even one member of a surgical staff in isolated instances, in small hospitals, unjustly crushing capable men at times, is often due to the machinations of an operating-room supervisor, or a lax Superintendent, who through cowardice or blindness lets it grow. The sale of sterile goods, gauze, cotton, saline, Dakin solution, is not made for the sake of the revenue, but solely as an emergency measure to assist some surgeon in relieving a patient. The patient may be black or white, far or near, rich or poor. The surgeon may be a man of weight or not. That is not the point. Doctors are supposed to have offices of their own well equipped with reserves to take care of all the work they undertake. It is only when there is an emergency happening to the surgeon himself (*e. g.*, he has his supplies in his car on his way and the car skids and smashes the Dakin bottle) that he should call on the hospital, and when it can be had nowhere else. In other words, the public is not contributing charitably to maintain an institution with high salaried workers under undue mental strain and irregular hours, and that most expensive of all academic forms, a training-school, for the benefit of patients outside, whom it never sees. Doctors who are now getting calls requiring Dakin, *should have earned their reputation* by having their own office always well provided with pure Dakin. In estimating the cost of goods sold to the outside public, *e. g.*, gauze, cotton, saline, Dakin, one must refer back to the ledger account for the operating room. *Money is not enough* to pay for handing operating-room supplies outside. The pupils

have to stay overtime to make them. There may have been an extra heavy demand on saline and only a couple of Florence flasks left, and if the very surgeon who asks it for an outside case, had another case come in and need it and did not find any, he would be the most angry. It is a good idea to issue report of sales monthly to the medical board. The cost of maintaining pupils long enough in the operating room to receive sound training must include the salary of graduate nurses doing general duty on the ward to relieve her, and of graduate nurses as circulating nurses in the operating room when there is a dearth of pupils for it. In other words, the scarcity of pupils raises their cost, both when they are on this service and when there are none. Looking on the account appended, the disproportion is pitiful, and it is going to take a great deal of time and attention from the best brains of the country to make a perfect system of accounting. The proof of the injustice of the present system is the reluctance of successful though disgruntled surgeons to open their own institutions. The concise aim to benefit the patient is the only safeguard.

The fifth quality necessary for a successful executive is being well informed, ready to take a leaf out of another fellow's book. Text-books in medical jurisprudence and journals containing recent verdicts should line the shelves of her office. Visits for study of other systems should be frequent and thorough, not casual, as for a semiholiday. What is gleaned should be noted and reported.

Very essential, indeed, is the training for such a job, gained under a capable person or as a spoke in a very large institution in good standing. The selection of a Superintendent being, of course, based on careful investigation of credentials, she should immediately study her hospital in its relation to the county, state, and nation, and help make it creditable through the operating department, by aid of the Directress and supervisors.

Seventh, when the hospital is important enough to have two heads, the Superintendent should have outside

DR. TO	OPERATING ROOM			CR. BY
		1924		
Instruments, needles...		Jan.	1	Operating-room fees...
Electric lighting.....				Petty sales.....
Gauze, cotton.....				Refunds.....
Steam for disinfection and sterilization.....				
Gas, ether, chloroform masks.....				
Alcohol.....				
Cleaning materials....				
Supervisor's salary....				
Pupils' salaries.....				
Salaries of graduates below, on general duty (replace pupils).				
Infusion sets.....				
Salaries of graduates in O. R. on general duty (if no pupils).....				
Plaster, glass, rubber tubing.....				
Gloves, adhesive.....				
Hypodermoclysis sets..				
x-Ray work.....				
Gowns, towels, sheets, blankets.....				
Equipment (tables)...				
Brushes.....				
Catgut silk.....				
Enamel basins.....				

contacts. The ill effects of the usual cloistered life of an officer in a small American hospital is felt in the one-sidedness of her views, in her ignorance of special local conditions which are deeply rooted in the life of the people, and are perhaps minimizing the usefulness of the one and only operating arena in the community, whereas by church, Red Cross, school, and club affiliations she may learn the values set by all the towns' people on many doctors whom she does not yet know, gleaning here and there enough local data to maintain a fair balance inside the institution, which should be for all, particularly in surgery.

The Superintendent should be distinguished by her intensive study of the institution, watching for co-operation in the laundry with the strenuous needs of the operating room, making expert reports on the actual wear and tear of materials, preventing all forms of waste, of catgut, alcohol or electricity, observing the faithfulness of

each employee, perusing the history of the hospital and trying to discern its lack, so that, the latter corrected, it may function at its maximum. She need not be, further than her training, different from any other high type of citizen, afraid of nothing, willing to move on, if she finds her ideals do not elicit response, wearing no man's collar, and resting all her judgments on the welfare of the patient. She should constantly endeavor to grow mentally and in tolerance and sympathy, and to have true growth from within in the hospital. Seeking advice from a famous hospital consultant on knotty problems will give her a better perspective.

She should look upon the operating-room supervisor as one does on the mechanician for a high-priced Rolls-Royce, whose engine has better timing gears and easier gearshifts than those in many other cars, on account of the high standard of its delivery, and should supply whatever is asked, when the need is mentioned and demonstrated, so long as it is in proportion to the means of the institution.

Need it be said that the moral code of the Superintendent must be of the highest, adamantine caliber, because of the severe tests to which it is subjected, in helping to clarify or at least honestly present situations arising between various elements? If she falls short in any one of the numerous qualifications mentioned above, there may be an instant débâcle, and merely to cringe in the presence of a blusterer or egoist may cause lasting damage. She is the representative of the public, the clergy, the teachers, all moral forces, through a moral Board, for a fixed period, and though the hostile or selfish may be present, she should speak fearlessly for the friendly or self-sacrificing absent ones. In this day and generation life is held cheap not only by its frequent destruction *per auto* but also *in utero*. The moral fiber of the Superintendent, who should view her hospital and its printed reports as if from the outside, should be so sturdy that the pupils trained in such institution will be in future

community builders of a high order, scorning to take part in the insidious agencies that offset decent effort to conserve the American race. Appended below is the safest guide for operating-room supervisors ever printed (courtesy of St. Elizabeth's Hospital, Lafayette, Indiana, in Hospital Progress, October, 1922):

SURGICAL CODE, ST. ELIZABETH'S

Before beginning any operation in this hospital, the surgeon is required to state definitely to the Sister in charge of the operating room what operation he intends to perform.

The following operations are inethical and may not therefore be performed:

1. Operations involving the destruction of fetal life.

Such are:

(*a*) Dilatation of the os uteri during pregnancy and before the fetus is viable.

(*b*) Introduction of sounds, bougies, or any other substances within the os uteri, during pregnancy and before the fetus is viable.

(*c*) Induction of labor by any means whatsoever before the fetus is viable. Neither eclampsia nor hyperemesis gravidarum constitute any exception to this rule.

(*d*) Curetment of the uterus during pregnancy.

(*e*) Craniotomy of the living child.

(*f*) Operations directly attacking a living fetus in extra-uterine pregnancy, in the absence of material shock from hemorrhage and before the fetus is viable. Where operations for extra-uterine pregnancy in the fallopian tube are performed, the rent or rupture in the tube must be repaired whenever possible.

2. All operations involving the sterilization or mutilation of men or women, except where such follows as the indirect and undesired result of necessary interference for the removal of diseased structures.

Operations specifically forbidden are:

(*a*) Removal of an undiseased ovary. Whenever an operation for the removal of a diseased ovary is performed, enough of such organs must be left intact if possible as will permit the same to function.

(*b*) Removal of a fallopian tube which is not so diseased as to require removal.

(*c*) Section of undiseased fallopian tube.

(*d*) Operations which result in obstructing the lumen of an undiseased fallopian tube.

(*e*) Hysterectomy where the uterus is not so badly diseased as to require the operation.

(*f*) Ventral suspensions and anterior fixations or ventrofixations so-called, in women of childbearing age, in the absence of proof positive of their necessity.

(*g*) The sterilization and castration of male patients.

The fetus may be considered viable after six calendar months.

If the fetus is known positively to be dead, operations for emptying the uterus may be performed.

The question of the presence of life, and of the necessity for the removal of the reproductive organs, or interfering therewith, by surgery or medicine, must in all cases be determined by previous competent consultation.

All structures or parts of organs removed from patients must be sent in their entirety, at once, to the pathologist for his examination and report. These specimens will, after examination, be returned by him to the operator on request.

When a pregnant mother dies before delivery an effort must be made in all cases to procure the baptism of the unborn child. (This has not universal application.)

It is possible that advances in surgery and medicine may render permissible some of the prohibitions of this code. Until further notification, however, the same must be followed as outlined.

The above rules are mandatory and the violation of any one of them will result in excluding the operator from the privileges of the hospital.

It is not sufficient that these be reported to the Board of Health. It has not worked out well universally. Booking cases requires considerable acumen and quick thought and confidence in an upright board, otherwise the private rooms of small, struggling hospitals become the mecca of patients of a very shady moral hue, as well as of some private hospitals run only for gain. Pathologic findings on specimens carefully collected by an honest supervisor, honestly reported without collusion, will expose a delinquent from whom privileges are at once to be withdrawn.

When an emergency case comes in, the operating supervisor should be given the first report, so as to be completely ready in time. When an article of value is broken and required soon, no time should be lost in sending a special messenger if necessary, in person for one to replace it. The narrowness of this life and the method of voluntary subscription induce some officers to haggle and delay over a purchase, but looking at it from the standpoint of the man in the street, if, for $2 outlay you can operate your machine and bring in a revenue of $150, spend it quickly.

Some Superintendents keep too much aloof from this

branch of the service, as if it were contagion, knowing full well that it is the arena for friction. That is shirking, and leads to subterfuge and deceit in under officers. Others attend when favorite surgeons operate, and dominate the assemblage in a loud voice, forgetting technic and bumping against sterile tables. This is undignified, and weakens authority. The unobtrusive, well-timed visit of a silent, all-seeing officer, who conveys her support in a glance to a faithful staff at a trying moment is worth her own weight in gold to the institution.

Buying for the operating room requires special committees, familiar with types of goods, and things not to buy are most important in a hospital or private home. Nothing should be bought just because it is inexpensive. It may never be needed. Nothing should be bought at the request of only one person; the virtues of the article must be demonstrated to the approval of all. Articles for the operating room should not be out of proportion to those of the rest of the hospital, whether it be ward, dining-room, or laundry, either in number, quality, or cost. Glaring colors, fads in styles, and designs of toweling that are not continuously uniform, so as to be known always instantly by sight as "O. R.," must not be purchased. Cheaply made goods have inferior dyes, and these, in turn, not being fast, ruin more valuable garments; for example, a whole set of doctors' suits, trousers, and jackets were made pink by the colors running in some cheap new towels in one metropolitan hospital. All purchases should be made by or at the will and choice of the committee on surgical affairs. Time should be taken by the forelock, and samples tried out long before the actual need to purchase.

These various difficulties can rarely be well met by one person. The Superintendent, not actually engaged in nursing, does not *know* how certain goods operate. The operating-room nurse knows where they fail, but has not time to weigh, count threads, meet several salesmen on one class of goods, or write for samples and price

lists. A "buyer," so-called, cannot buy on his own first-hand information. He must collect statistics from the house and from his own bills to satisfy an exacting superintendent. In some cases the buyer is so busy justifying his own existence that he puts in an inferior class of goods or too small a quantity, to the hampering and unhappiness of the workers. Then he cheerfully asks for an increase of salary, to utilize the margin he made, where it can do the greatest good to the greatest possible number—Number One.

For all hospitals the simplest solution for the problem of buying is to become a member of that ingenious purchasing body, reaching from America to China, and capable of buying anything from drinking straws to dictaphones, called the **Hospital Bureau of Standards and Supplies,** which is a club consisting of representatives from the largest and best equipped charitable institutions who have joined, with a fair membership fee, to support the actual buyers on salary, and who can then not only secure goods at a big discount from the wholesale firms, but have no anxiety about selection or delivery. They place their orders at the head office of the association, whose buyers at once send what they wish from the supply houses of the wholesale dealers with whom this bureau has fixed yearly agreements relating to that kind of goods. It is really a very extensive mail-order business. But it is not conducted for the profit of one individual. Hospitals are not *money-making* concerns. These buyers must weigh all goods, taste all tea, coffee, sugar, etc., count the threads per inch in gauze or wool with a magnifying glass if necessary, inspect cotton under the microscope, test the joints, valves, and bars in all plumbing apparatus, and only buy in houses whose goods meet the proper specifications. Goods are delivered very quickly and perfect satisfaction is guaranteed. This eliminates at least one salary in institutions of some size, and in the small hospital releases the Superintendent to attend to the real superintending, of which buying should not be

the only duty performed, otherwise certain basic principles must be observed in buying. Good goods produce efficiency in the care of the patient, but they must be strictly accounted for in placing, number, length of use, and suitability. Buying a large quantity prevents expense in freight and causes a feeling of security, while the goods are not wearing out. The responsibility of caring for the stock in bulk must be placed on very few, not only to keep it in order, but to distribute it weekly. **Trade names** have been paid for twice over. "Hexamethylenamin" is bought very cheaply and used exactly as "urotropin" used to be; "thymol iodid" performs the same duties as "aristol," but is much cheaper. But a drug must not be bought and used this way until it *responds to tests correctly.* When buying certain articles on requisition from the operating room every feature must be described—*e. g.*, a jar for saline infusion must be graduated to 750 c.c., beginning *at the top* with *0* c.c., or, again, the length, style, material, eyes, stylet, beveled tip of lumbar puncture needles must all be specified.

Whisky and **brandy** should be of the best quality and then kept under lock and key, whether in bulk or on the wards. Hospital whisky, as a rule, is a joke for its universal badness, unfit for both mouth and hypodermic medication.

Alcohol may be bought at a very low cost in its denatured state if the proper forms are executed. The president of the Board of Governors must sign a bond for $5000 for each barrel of alcohol kept in stock continuously by the institution as a guarantee that its use is confined to surgical, nursing, and pathologic ends. Were any one with evil intent to drink or otherwise depart from the legal uses of this liquid the president would have to forfeit this sum. An account, therefore, is kept of the use of all of it, and the care of it is left to a very conscientious official, who keeps it well safeguarded for the president's honor. When the liquid is being ordered an affidavit is taken by the Superintendent and president to

the effect that its use has been honest. For use following carbolic acid as a cautery, however, alcohol must be used in its *pure*, not denatured, state, on the stump of the appendix.

As to catgut, if the committee on surgical affairs were to visit and make comparisons of the various plants or laboratories where it is made wholesale they would become impressed with the folly of trying to do it themselves and the justness of the prices imposed. Possibly they could also detect differences between the materials and preparation of these various firms such as would warrant the difference in prices; at any rate, in these days of keen competition, when every manufacturer knows the secrets, initial cost, and overhead expenses of his rivals, it cannot be disputed that when there is five cents' reduction in the price there is five cents' reduction in the value. It is not necessary to pay only for a name, but when a name means confidence and merit it is wise to procure the best. Surgeons who thoroughly identify themselves with the highest interests of a hospital are economic of catgut. Their sutures are uniform for certain purposes. It is then easy to buy various lengths of catgut, done up in separate tubes for various purposes.

Emergency Orders.—In a crisis that *could not be foreseen* one is justified in ordering by messenger, special delivery, parcel post, or express; but for all that can be foreseen freight is suitable and cheap, boat transportation being again less expensive than the railroads. Large firms appreciate regular methodical foresighted ordering.

Important supplies that concern the actual knack or handicraft of a surgeon should be bought by the committee on instruments with grave deliberation, not by the Directress of nurses or the Superintendent who has never fitted them to the hollow of her hand for an hour in the greatest crisis of a patient's life.

CHAPTER XX

DUTIES OF THE NURSE IN ORTHOPEDIC SURGERY

Classification.—(*a*) *Open work* on bones, requiring the most assiduous efforts at asepsis (discussed previously).

(*b*) *Closed operations*, showing no open wound; breaking, straightening, or overcorrection of deformity.

Definitions.—Surgical Diagnosis and Instruments.—For deformities certain technical terms are used:

Congenital dislocation of the hip. A deformity existing from birth, the head of the femur being lodged outside the acetabulum, with the formation of powerful adhesions. Frequently this occurs in both sides.

Funnel breast. A depression of the chest walls at the sternum resembling the bowl of a funnel. It is like a shoemaker's chest, only it may occur at any point. It is corrected by very strenuous exercises, not by operation, but must be done early to abort any hereditary predisposition to tuberculosis by increasing the child's lung capacity.

Genu valgum. Inward curving of the knee, knock-knee, opposite of bow-legs.

Genu varum. Splay foot; synonym of *talipes valgus*, bow-legged; inner part of the sole rests on the ground.

The preceding are neuter nouns and adjectives, therefore the latter end in *um.*

Hallux valgus. Displacement of the great toe toward the other toes.

Hallux varus. Disposal of the great toe away from the other toes—displacement.

These are masculine, therefore ending in *us.*

Hip disease. Usually tuberculous and in the young. It lodges in the head of the femur, in the acetabulum, or in the synovial membrane and proper structures of the

hip-joint. The early symptoms are shuffling gait, pain on the inner side of the knee, pain in the hip on jarring the heel, deformity, shortening of the limb, suppuration, and formation of fistulæ.

Kyphosis. Angular curvature of the spine, the prominence extending posteriorly.

Lordosis. Curvature such that the convexity points forward.

Osteoclast. Instrument to break bones to correct deformity (Fig. 48). Do not confuse with the term "osteo-

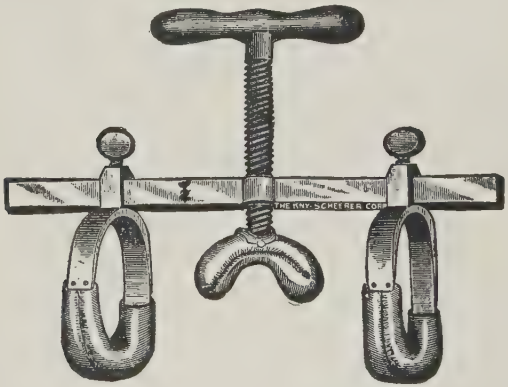


Fig. 48.—Osteoclast (Phelps' modification of Grattan's).

blast," which means a cell found in the formation of bony tissue in the embryo.

Pott's disease. Curvature of the spine with a posterior projection due to spondylitis or inflammation of a vertebra. It is usually tuberculous. It may be high or low. When high, it is more quickly discoverable; when low, it shows up usually as a psoas abscess, the inflamed area breaking down into pus which migrates downward along certain muscles toward the inguinal region. The symptoms of Pott's disease are stiffness of the spinal column, pain on motion, tenderness on pressure, undue

prominence of one or more spines, and a particularly wistful facial expression.

Scoliosis. Lateral curvature of the spine, bending of the column to right or left.

Talipes. Club-foot.

Talipes equinus. The heel is elevated, and the weight is all thrown on the anterior portion of the foot, like a horse's foot.

Talipes planus. Flat-foot.

Talipes valgus. Foot turned outward.

Talipes varus. Foot turned inward.

APPARATUS AND HOW IT IS USED

Bradford Frame.—This may have to be constructed quickly to provide horizontal fixation in cases of children suffering from fractures or from tuberculosis of the spine. The frame itself is of bent gas-piping, from $\frac{5}{8}$ to $\frac{1}{4}$ inch thick, in a perfect oblong, 1 inch wider than the patient's body at his hips, and 6 inches longer than his full stature; that is, in the proportion of about 1 to 5. It is covered by a piece of stout canvas twice its width, and laced down the back on the center of the side away from the child with eyelets and stout laces. It is arranged to leave an opening for the bed-pan, which, however, does not interfere with the tautness longitudinally, which is taken care of by two pairs of webbing straps at the head, and again at the foot. This frame is constructed to obliterate pain, and the child can be very comfortably carried on it. In spinal cases he may lie and kick all he pleases if his feet are warmly clad. As to bodily clothing, otherwise, when he is *applied* to the frame, he wears only undershirt and diaper. His warm dress is put on, last of all, over the jacket of the frame. Two thick pads of felt are sewed on the canvas, each 7 inches long and $\frac{3}{4}$ inch thick, to protect the hump from pressure and to increase the leverage of the apparatus. Mangle felt is excellent for orthopedic purposes. There should be a small square of rubber covered with muslin at the region of the buttocks.

To make the frame more effectual it may be bandaged with strong muslin bandages, with edges turned in, before applying the laced canvas top. This frame is gradually bent, under the kyphosis, to curve upward *from the bed to the hump*, the ends resting on the bed. This obliterates the hump in time. Much orthopedic work with braces, frames, and suspension apparatus is really a daily "operation" by the nurse. The child is taken off the frame daily, handled painlessly, bathed, rubbed with alcohol, and powdered. It is essential to have two canvas covers for each frame. To secure the patient to the frame an apron of canvas, covering the child's chest from the armpits to the hips, is provided, with three pairs of straps of webbing and buckles, fastening in the back on the under side, immobilizing his body. The fixation must occur in the region of the disease—*i. e.*, for lumbar disease a broad binder should be passed over the hips, and if there is psoas spasm, traction is usually employed.

Buck's Extension (Fig. 49).—This consists of the following parts, all of which should be kept together in a set in a chest:

(1) Two strips of moleskin plaster, each 2 or 3 inches wide and extending from the seat of the fracture to the internal malleolus.

(2) An alcohol flame to melt the adhesive.

(3) Two pieces of webbing for each leg, to be stitched to the plasters at their ankle end, 2 or 3 inches wide and 6 inches long.

(4) Five other strips of moleskin, each 1½ inches wide, to encircle the leg, the knee, and the thigh, also to extend spirally from the malleoli around the leg and thigh to the seat of fracture.

(5) Roller bandage of 3-inch muslin, with the edges turned in during application, then stitched in neat rows, to be kept in place.

(6) A curved or straight ham, or posterior, splint properly padded.

(7) Three coäptation splints to surround the thigh.

(8) Six webbing straps with buckles or strips of bandage to be used as straps.

(9) Fresh sheets, pillow-slips, or towels as pads.

(10) A straight abdominal binder for the pelvis.

(11) A long axillary or outside splint of wood, 4 inches wide, from the axilla extending 6 inches below the sole of the foot.

(12) To this is nailed a cross-piece 18 inches long, making a T.

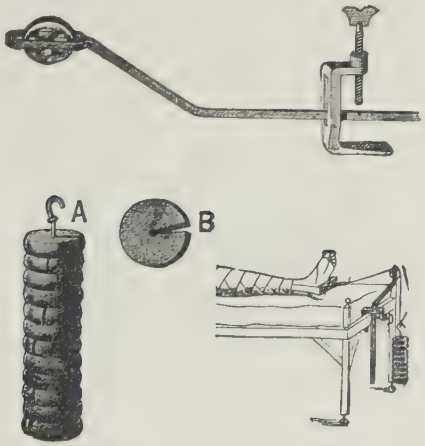


Fig. 49.—Apparatus for Buck's extension, with rope and weights.

(13) Two towels, soft and old, or $2\frac{1}{2}$ yards of flannelette (one-fourth the width) for a perineal strap.

(14) Safety-pins arranged with their points in a cake of Castile soap.

(15) A pulley, screwed into a broom-handle cut the right height or attached to a special iron bar (part of the set) that clamps in two places to the bed frame.

(16) A spreader, being a piece of wood 2 inches wide and a little longer than the width of the patient's foot, with a hole bored in the center for the cord, on which hang the weights for extension.

(17) A piece of clothes-line (cotton rope) 4 or 5 feet long.

(18) Two shock blocks to elevate the foot of the bed.

(19) Four sand-bags with white muslin slips, each 20 inches long and 6 inches wide.

(20) A square cradle, made of pine, fir, or cedar, to keep the weight off the limb.

(21) A soft, warm old blanket for the limb, lying closely over it.

(22) Cotton covered with gauze to stuff into corners (this prevents fluff from spreading through the bed).

(23) A fracture-board or a plain level old door, with holes bored through it to air the mattress on the under side.

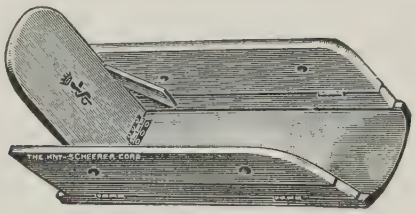


Fig. 50.—Fracture-box.

(24) Needle, thread, thimble.

(25) Tape-measure.

(26) Weights, graduated and recorded as to amount, when used.

(27) Anesthesia set, vaselin, pus basin, towels, etc.

(28) A railroad (old-fashioned, but still in vogue)—a track of wood on which the leg glides smoothly.

Such a list as this, combining with the basic articles here enumerated any favorite materials of the operator, should be posted in the treatment room where this sort of work is done.

Jury Mast.—A frame of tempered steel, leather straps, and canvas to straighten and lengthen a curved spine, including as points of support the brow and chin and a

point in the plaster jacket well below the deformity. Each must be accurately fitted to the individual and altered to suit his development. The hump must be well padded. Even with the most careful intentions frightful pressure-sores are caused by inexpert handling.

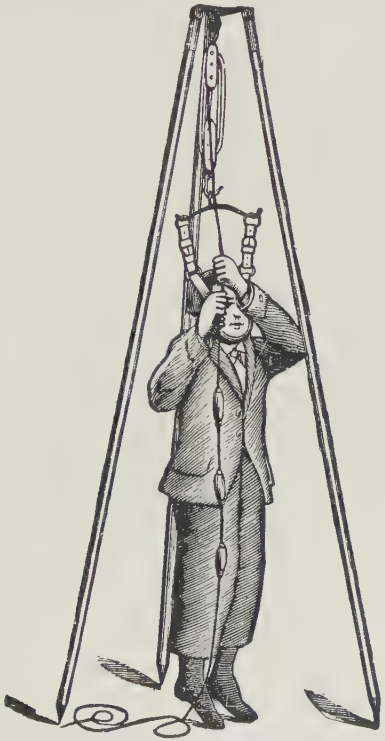


Fig. 51.—Sayre's suspension apparatus for application of plaster jacket, or exercises.

Fracture-box.—A support for the leg when the tibia or fibula is broken (Fig. 50).

Sayre's Suspension Apparatus.—A tripod, joined flexibly at the top and securely fastened when in operation

by spikes into the floor. From the center at the top on a pulley runs a halter, adjustable to a collar, that thus supports the patient by the neck and chin. It is fitted to him, and he is then slowly raised until his toes are just off the floor. Then over only a knitted undershirt, with the proper pads and "scratcher," a plaster jacket is applied (Fig. 51).

Modified Buck's Extension for Hip Disease.—There is no splint as for fracture, merely the weights. The patient

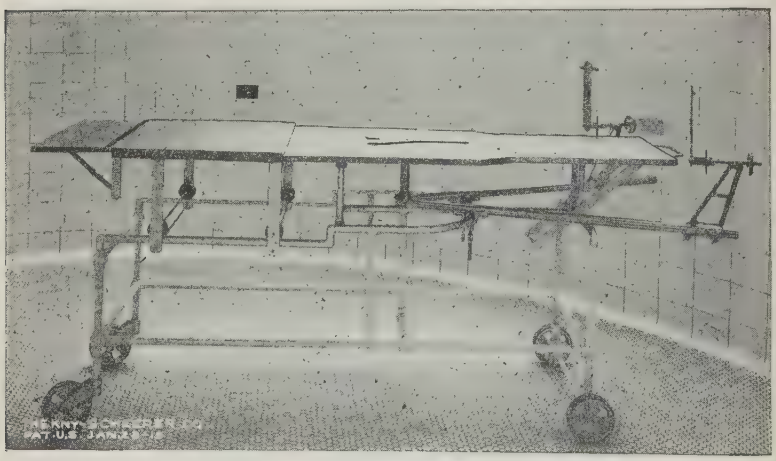


Fig. 52.—Fracture and orthopedic table in position for treating fracture of the lower extremity—adaptable to rontgenographic examination.

is secured around the waist by a folded towel from which a bandage runs up to the head of the bed. With large children a perineal strap may be used. In any case the foot of the bed may be elevated.

Orthopedic Tables.—It is most unusual to find a standard orthopedic table outside the special hospital, but it is an excellent though very expensive article, consisting of a series of contrivances for procuring leverage, elevation, gaps to pass bandages, extension, *x*-ray, etc. (Figs. 52, 53).

Plaster Bandages.—In hospitals where orthopedic surgery does not constitute a special branch of work there are at least many occasions when plaster casts must be applied. To make the bandages are required:

(1) A large flat tray.

(2) The best of crinoline, of a standard fineness and thickness, this being the foundation of the whole system.

(2) Excellent dental plaster of Paris.

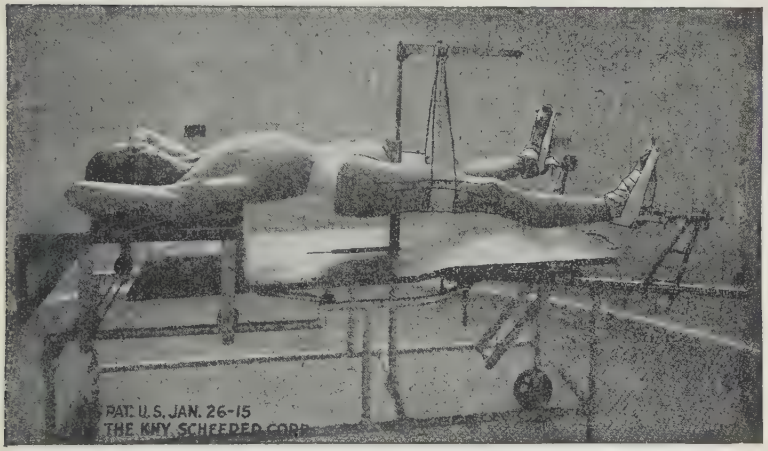


Fig. 53.—Fracture and orthopedic table, illustrating control of the leg in bone-plating for fractures.

(4) A spatula to apply the plaster to the crinoline, though most nurses prefer to go ahead with the bare hands.

(5) A tape-measure and stout scissors to measure, cut, and roll the crinoline in *5-yard lengths* of the usual widths —3, 4, 5, and 6 inches—selvages cut off, also four or five threads raveled off.

(6) Small round tin boxes, one for each bandage, lidded, in paper napkins or squares of blue tissue such as comes with cotton to roll up each bandage separately, then

laying them on their side in a larger square tin box, with lid, to be kept perfectly dry.

(7) A rubber apron and, if the skin is abraded or suffers from contact with irritating clays, thick rubber gloves.

(8) A solid stool and table with foot-rest.

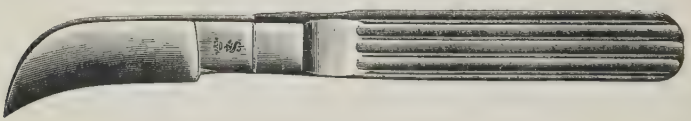


Fig. 54.—Curved plaster-of-Paris knife.

The bandage must have all the plaster it can hold, and this must be evenly distributed throughout its whole length. It is set on the left-hand side, unrolled, filled with plaster, much lying under it on the tray, smoothed, and rolled up to keep it ship-shape on the right as one goes along. It must be rolled only about 75 per cent.

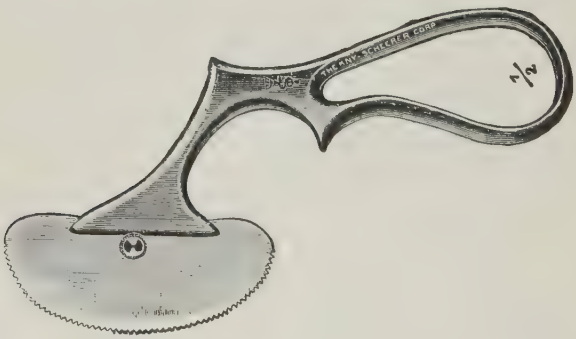


Fig. 55.—Saw for plaster-of-Paris cast.

tight—that is, fairly loose—so that water may circulate between the layers of plaster later.

It must always be handled very gently. It is of vital moment to keep up the stock of plaster bandages. If on any one day they run too low, they should be *replenished that same day* before the nurses go off duty.

For **putting on a cast** the following articles are required:

(1) Gown, rubber apron, and unsterile rubber gloves for the surgeon (also rubbers with high tops to cover his shoes, if he chooses).

(2) Newspapers, rubber sheets, etc., to cover the floor.

(3) Ammonia, alcohol, or vinegar to soften the old cast or cleanse the hands.

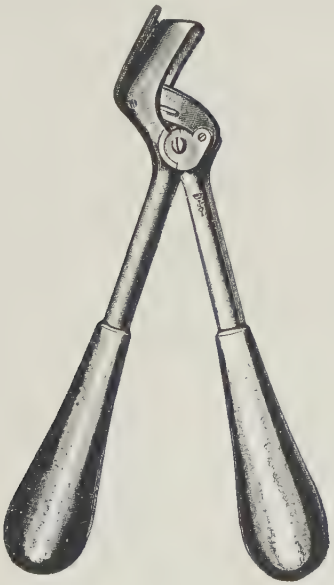


Fig. 56.—Plaster-of-Paris shears.

(4) Special knife, saw, and shears for cutting casts (Figs. 54–56).

(5) Stockinet, shirt, drawers, or stockings of cotton or Balbriggan to protect the body (the pupils should save all their cast-off white hose for this purpose, especially for arm cases); bandages of stockinet are good for any portions of the body not ordinarily clothed with knitted goods.

(6) Mangle felt in strips or squares, to pad or give elasticity with compression.

(7) Sheet-wadding, glazed, preferable to cotton, in many rolled strips, 4 inches by 1 yard.

(8) Cotton, alcohol, and powder to rub and pad all humps or edges, even after everting the stockinet cuffs.

(9) Oiled silk, to form at the edges near the genitals a surface impervious to urine or stool.

(10) Hip rest of metal or wood (also convenient for the spica in hernia) if no orthopedic table is to be had.

(11) A large enamel basin, 8 inches deep, in which to set the bandages on end, with plenty of space for the water to submerge them plus the nurse's hands, without overflow.

(12) Water at the temperature of 100° F., kept so by adding hotter from time to time from a pitcher nearby; a bath thermometer.

(13) A solid table protected with rubber sheets, large and small, and an old cotton blanket.

(14) Old soft blankets on the patient; warm-water bottles, each with two covers not warmer than 110° F.; a burn through a cast, not being easily discovered, is apt to be very deep and lasting.

(15) Cotton rollers—tear sheet wadding lengthwise in desired widths and sew two lengths together and roll.

(16) Plaster bandages, 3, 5, 7 inches.

(17) Gauze bandages,1, 2, 3 inches.

(18) Muslin bandages, 1, 2, 3 inches.

(19) Gauze.

(20) Iodin, 4 per cent.

(21) Heusner's glue with brush.

(22) Extra plaster and spoon.

(23) Salt.

(24) Doctor's towels, gown, gloves, powder.

(25) Two pails and a colander.

(26) Equipment for anesthesia, p. r. n.

Special Instructions to the Nurse.—(1) Set the bandages on end, only one at a time, and hold them so with

both hands until they are wet through. Bubbles begin to rise continuously in their center, and when these bubbles cease they are wet enough.

(2) Squeeze the bandage until one-half the water oozes out, then hand it to the surgeon so that he may take the bulk of the roll in his right hand and the free end in his left. The distance from the nurse's basin to the surgeon's hand should be the shortest possible.

(3) Just as soon as the nurse relinquishes one bandage, she removes the wrapper and steeps a second, that time corresponding to the length of time required by an expert orthopedic surgeon to apply one.

(4) When all are on, she should, with both hands, scoop up the sediment left after pouring off the bulk of the water and pass it to the surgeon or keep it soft and equally mixed while he makes with it an extra coat quite smooth over all.

(5) At times it is necessary to bolster the cast by first applying a plaster splint which is best made on the operating-table. Therefore a space must be cleared by flexing the patient's other knee, or on the work-table used by the nurse, a glass or rubber surface being preferable. The measure is taken on the limb, then a wetted bandage is laid flatly on the table and folded on itself longitudinally. If this were a 5-inch bandage it would make five thicknesses 1 yard long and 5 inches wide, which would probably be thick enough. These splints are always made the single width of the bandage provided. Their length depends on the bone being set.

(6) When a cast has been put on, the old cast is broken up into small fragments to fit the trash-cans easily, and to avoid scaring some one who comes across a ghostly limb in the dark basements.

Most important of all, *the plaster must not be poured into the sink or hopper*, since it sets and stops up the plumbing. The basins should be scooped out into papers, thickly wrapped about, and put into the trash-cans.

Adhesive Plaster Strapping for Flat-foot.—Adhesive

plaster, 15 inches long and 3 inches wide, beginning at the outer side of the ankle just below the external malleolus. Adduction of the foot (drawing it up inwardly to form an artificial arch). Passing the plaster tightly under the sole, up the inner side of the arch and leg. Two small strips of plaster, 1 inch wide, crossing it at the top, to keep it in place, but not completely encircling the leg lest they cut off the circulation. Measure with a tape before cutting. Then cut a series of six strips of adhesive, 15 inches long and $\frac{3}{8}$ inch wide, and cover this same area again, laying the back edge of each over the front edge of the one preceding, and catching them alternately in a braided or basket pattern, coming down from the top, with small strips running horizontally, working down to the malleoli, but leaving an open path down the instep, $1\frac{1}{2}$ inches wide, which may be bordered with two strips of the proper length to cover the raw edges. Over all apply a firm bandage. This should be removed once a week with ether or benzine, the foot examined and cleansed, then dressed again.

The **Lorenz operation for congenital dislocation of the hip,** consisting of bloodless reduction, retention, weight bearing.

For bloodless reduction no instruments are required but the surgeon's hands; a thick folded sheet beneath the patient's buttocks; a wedge of wood (for all but tiny children) about 5 inches long, 3 inches wide, and suitably padded to form a fulcrum under the head of the femur; a second sheet folded diagonally to make traction from the perineum, with the ends tied about a corner of the table.

If the reduction requires two sittings, a plaster spica is required for the first, and certainly after the last. The following special articles are to be provided:

(1) A close-fitting long stockinet shirt, one-half of which is cut and sewed to cover the limb as a drawer leg would do.

(2) This drawer is "threaded" with a long bandage,

called the scratcher, which runs down as a loop inside the drawer and up outside the cast, to give the patient or nurse a means of rubbing the skin underneath when it itches.

(3) The hip or pelvic rest to elevate the body for all spica work.

(4) Sheet-wadding, with glazed surface preferably, or cotton in long rolled strips, 4 inches wide, to cover the pelvis and thigh thickly.

(5) A firm bandage of muslin for elasticity and compression (may be preceded by a fine smooth gauze bandage).

(6) The plaster spica, very thick and firm, consisting of a dozen or more ordinary plaster bandages, embracing the iliac crests, the buttocks, and the leg to, *but not over*, the knee-joint.

(7) Plaster scissors to cut away the edges; then they are everted.

(8) Stout thread with needle to sew the stockinet (when it is smoothly turned up over the edges) to itself.

(9) The stimulation tray with the anesthesia set, because deaths occur from the violence of the rupture of these congenital adhesions under the anesthetic.

(10) A cork sole of $1\frac{1}{2}$ to 3 inches in thickness should be early ordered for the affected foot when walking begins in the third week.

Transplantation.—For ununited fracture, Pott's disease, etc., a very small piece is excised from the fibula (usually) and dovetailed into a crevice hewn out of the affected area. The hole in the leg is replaced by healthy, granulating bone tissue, *not callus*.

Callus occurs in fractures. Small pins or dowels of fibula bone are inserted or mortised into holes drilled in the graft to maintain it *in situ*, just as a clever cabinetmaker secures the parts of a chair with pegs. The tools are automatic, electric driven, reducing the shock of the operation by their speed. When a man is shot with a

fast bullet he does not know he is shot till he sees the blood. These tools must be divided into two classes,

Boilable,

Non-boilable,

and woe betide the nurse who errs. The operation is very spectacular, and stirs up much interest on account of the universal appeal of tuberculous patients. The saw must be kept wet.

Poor and improperly prepared materials hamper the orthopedic surgeon very greatly. He is a *surgeon plus.* He has to have a true eye, and the skill of a sculptor, as well as the usual qualities of the surgeon. Imperfect results are charged against him very loudly and long by a disgruntled patient, because of the value, to us all, of a perfectly working arm or leg, both in a cosmetic and a commercial sense. The imperfection of the result must not be traceable to any flaw in operating-room methods. No matter how much natural aptitude or knack the surgeon has, he requires good support in

Good crinoline,

Good plaster,

Well-made bandages,

Expert soaking and handling of same.

Making plaster bandages is a regular part of operating-room training and should not be relegated to orderlies. Each pupil may be a future supervisor who should teach that, in no matter how metropolitan or remote a place. The Cook Plaster Bandage Machine is used successfully in Hartford Hospital, Hartford, Conn., as invented by Dr. Ansel G. Cook of that city. (See Modern Hospital, vol. xxi, No. 4, October, 1923.)

A New Plaster Knife.—A recent issue of the Journal of the American Medical Association, vol. 82, No. 1, January 5, 1924, contains an article of interest relating to a new plaster knife (Fig. 57), which reduces the fears of the patient as compared with the ancient pruning-hook.

This knife is designed to facilitate the cutting down of plaster casts and comprises a handle, shaft, removable

standardized blades, and a hand rest for pressure on the blades, an eight-pointed revolving wheel on the under surface of the shaft, and a pick at the end of the handle. The accompanying illustration shows the parts of the knife individually and assembled for operation.

Two knife blades operate parallel to each other at one end of the knife, with their beveled edges away from each

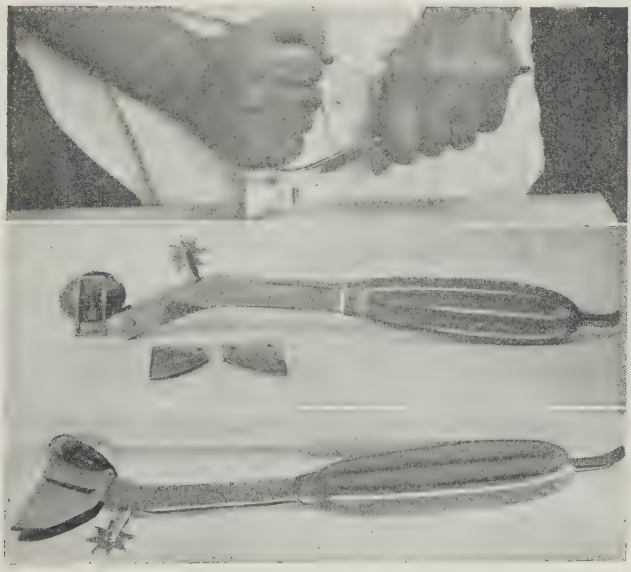


Fig. 57.—A new plaster knife designed by Herman B. Philips, M. D., New York: Above, assembled; below, individual parts.

other. They serve to cut a strip of plaster, thus obviating any possibility of jamming of the knife blades, which is a common occurrence with the usual type of plaster knife. The blades are standardized and easily replaced by unscrewing a circular knob, which holds them in position. The change of blades can be accomplished in a few seconds. The knob serves an additional purpose of permitting

pressure directly over the blades, so that more effective cutting can be assured. Just back of the knife blades is a rod pointing downward, supporting a revolving, sharp-pointed wheel. The wheel also serves a double purpose: first, that of cutting up the plaster strip made by the two knife blades, and second, that of affording a pivot on which the shaft of the knife operates, so that depression of the handle elevates the blades and, vice versa, the elevation of the handle depresses the blades and makes them cut deeper. At the end of the handle is a pick, which is used to pry open the plaster.

The knife has proved to be of considerable help, saving time and strength in cutting down plaster casts, in making fenestrations, etc.

Advantages.—1. This plaster knife can be made to cut superficially or deeply.

2. Margin of safety.
3. Blades standardized, easy to put in.
4. Knife permits rapid and easy work.

CHAPTER XXI

IMPROVISED OPERATING ROOM IN A PRIVATE HOUSE

When Needed.—With modern facilities for travel and the ever-increasing construction of hospitals, conditions requiring improvisation will likely exist only in the case of virulent contagion with surgical sequelæ, in the remote wilds, or in homes of means, where some personal feeling regarding hospitals or preference to keep small children at home masters the situation. Where unjust staff rules in a hospital shackle a majority of the community, much minor surgery can be and is quickly and effectually done in the home, and creates an interesting, profitable field for special nurses. Every nurse should cultivate the power of improvisation in this and all other departments, so as to save even the smallest expense, which even the wealthiest appreciate, a quality often lacking in institutional life where the persons who really pay the bills are never seen.

Progress in Serving Communities.—Just as the army equipped mobile operating-units, so, when necessary, single, isolated, or community hospitals may equip and send forth on a truck, the tables, goods, basins, flasks, and staff, who stretch a clean canopy in the room, and operate under favorable conditions. Naturally, the only doctor who may do this is one who has full staff privileges, hence the proper conception of the relation of the hospital to the community must be held by the directors.

Preparation of Room.—(*a*) For immediate operation, do not stir up ancient dust, but hang sheets. For twenty-four-hours' preparation take down everything, and dust, washing with bichlorid of mercury after the dust settles. Carpets must be removed (as a source of dust) or covered with oilcloth (impervious to any that could rise).

(*b*) Windows must be obscured by smearing with Bon ami, and the daylight rendered equally diffuse.

(*c*) Furniture of wood which must be used must be protected with oilcloth and thick pads of old newspapers, confined in thin old sheets.

(*d*) Lighting by kerosene lamp or gas is prohibited when using ether, which is inflammable and volatilizes in a long, continuous, invisible train which rises and by and by connects with the flame—hence, operate by daylight, electricity in the house, or batteries brought by the surgeon. The powerful searchlight on an automobile may be used to advantage.

The Tables.—The surgeon may bring an office table or regulation operating-table: (*a*) Usually an extension table is employed, fully extended, and the middle leaves removed, but a small square board inserted, same width as the patient. All is well padded, and protected from moisture and stains. The width of the two ends makes enough space for the operator's instruments and the anesthetist's outfit. The surgeon and his assistant stand in the "waist." (*b*) For very small cases, such as tonsils, or circumcisions, a stout kitchen table is best, being hard to spoil, but very solid. (*c*) For improvised Trendelenburg, which is not likely to be attempted in house operations, one can slip a chair, face down and well padded, on the foot of the table, or an assistant standing between the patient's thighs raises her legs over his shoulders, standing with his back to her, or one may elevate the foot of the table with blocks, boxes, or solid chairs, propping the other end to keep it from sliding. (*d*) For a sponge and instrument table an ironing-board passed through the first and third panels of a clothes-horse, and all covered with sterile sheets, makes a safe place, easily set up and put away. (*e*) For a bed operation, always put an ironing-board or a leaf of an extension table on the bed frame *under the springs*, at the patient's buttocks, for firmness.

The Anesthetist.—He requires a large soap dish or

Fig. 58.—Closed method of anesthesia.

Fig. 59.—Open method of anesthesia.

soup plate, as a kidney basin, and a cone for ether, for the closed method (Fig. 58) made out of a towel and a folded

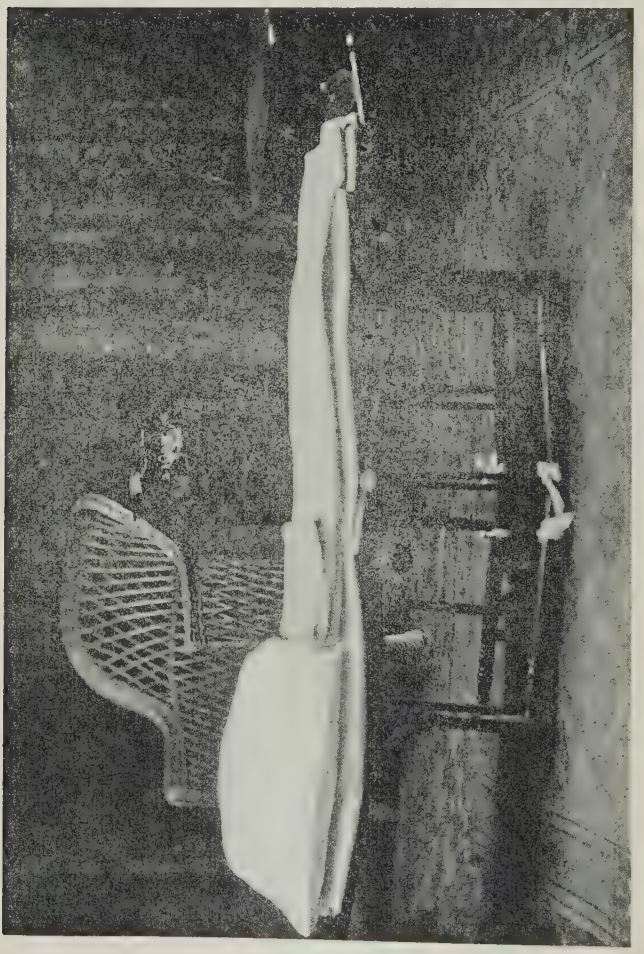


Fig. 60.—Improvised stretcher.

newspaper, or, for the open, or drop method (Fig. 59) a piece of flannelette over a tea or coffee strainer. Most

anesthetists carry their outfits. For stimulation the nurse has her own hypodermic syringe as usual.

The Stretcher.—A stretcher is made by laying two square chairs face down on the floor, their feet meeting. The legs are very solidly spliced and a piece of board laid and fastened in the center, then the whole covered

Fig. 61.—Improvised Kelly pad.

with blankets and draw-sheet. The upper ends of the chair or the top cross-piece make a secure handle. This stretcher stands at a good height by the bed for lifting the patient on or off with the aid of a folded sheet (Fig. 60).

Improvised Kelly Pad.—If vaginal work is to be done a Kelly pad (Fig. 61) is improvised as follows: Required,

a blanket, old and soft; adhesive strips, 6 by 2 inches; a rubber sheet or a piece of oilcloth, 2 yards by 1 yard; two hemostats; eight pieces of gauze bandage each 12 inches long. Roll the blanket tightly and tie it in one long cylindric roll. Lay it on the farther long edge of the rubber and roll toward the nurse, about two turns. Divide into three equal parts, the middle part at least being 2 feet wide. Grasping the roll firmly, turn at the first third at a right angle. Do the same with the last third. This leaves a triangle outside each side of the "Kelly pad." Reduce these triangles by folding to one-half their size, bring over the roll, interiorly, and fasten with adhesive, artery clamps, or, at the worst, safety-pins, in the oilcloth only, not through an expensive rubber. Let the apron hang over into the waste pail. The whole resembles a soldier's blanket on the march.

Nurse's Supplies.—(1) Cold sterile water, boiled in clean kettles the *night* before for a *morning* operation. Have enough kettles.

(2) Hot sterile water, boiled similarly a short time before the surgeon's arrival.

(3) Clean towels, old pieces of muslin of the size of a towel, put up in packages the day before, and sterilized as follows: Tie a cloth from handle to handle of a clothes-boiler to make a flat hammock above 2 gallons of water, and on that lay the packages. Lay the lid in position, and to its handle tie a heavy smoothing-iron to hold it down ("steam under pressure" or confined). Turn on the gas and *boil* for one hour. Remove the iron gently, then the lid *very* gently, so as not to permit the drops to fall on the packages. Lay them in a clean dry place to become perfectly dry, or dry them in the oven.

(4) Laparotomy sheet, table covers, etc., may be made out of sheets, pillowslips, etc. Do not destroy a good sheet for a laparotomy. Rather pin in position four pillowslips, fold, and sterilize.

(5) Saline made within the same day it is used requires only one sterilization. Two 1-quart bottles are sufficient.

The saline is made and boiled, if possible, the day before, filtered, and poured into two boiled bottles, which are then plugged with gauze and cotton and sterilized with the dressings. By being made triple strength and diluted twice with cold water, they can be cooled for use if sterilized again the day of the operation (set in a container of water and brought to a boil, then kept at boiling-point one hour).

(6) Vaselin, as a sterile lubricant, is set in its container (lid separate) in cold water, not quite to the edge, then brought to a boil and kept boiling for one hour. After cooling *in the container* (burned fingers being *res non gratæ* at this time) it is aseptically lidded and set aside. A small amount is taken out on a *sterile* grooved director when needed.

(7) Basins for the hands during the case will be found, from the gray enamel to the white stone china, in an old-fashioned bedroom. If enamel or china, they are disinfected by standing in bichlorid of mercury solution 1 : 1000 (preceded by vigorous scrubbing and rinsing).

(8) For an irrigator (seldom used) a boiled douche-bag or can, covered with a towel and hung on a weighted hat-tree with smoothing-iron or brick tied to the feet so that it will not topple, may be used.

(9) Instrument boiler, dish pan or fish boiler—must be long and not too narrow.

Surgeon's Garments.—Usually a man undertaking this work has, and will bring his garments, dressings, sheets, and towels. But if he were alone in the wilderness, hunting, with only his guides, he should be able to do fairly efficient work, as follows:

(*a*) Cap: A handkerchief, or piece of any washable material. A piece of gauze 1 yard square brought (doubled diagonally) from the back of the neck, barely escaping the tips of the ears and tied on the brow, with the central point tied in with it, makes a cool, serviceable cap.

(*b*) Mask: Improvised masks are made as follows: A piece of gauze $\frac{1}{2}$ yard square is, before the person scrubs,

laid up on his chin. The lower two points are twirled and tied up on top of his head. The upper two corners are twirled and tied over and behind the ears. Gauze or thin old handkerchief.

(*c*) Gowns: A loose pyjama coat with a skirt made of a draw-sheet and put on backward makes a practical gown. Nature is often very merciful to those wounded in the wilds.

Preparation of Patient.—This must be done simultaneously with the other work in the regulation hospital manner.

Demonstration.—In the last week of the suture nurse's service she should prepare, before the staff, a complete operating-room equipment in a private room:

(1) Using no technical hospital equipment.
(2) Minimizing expense, and giving table of costs.
(3) Taking the steps in chronologic order:
    (*a*) Making saline and dressings.
    (*b*) Preparing the room.
    (*c*) Sterilizing goods.
    (*d*) Preparing patient,

although not actually consuming the required time. She should be able to go into any home and give promptly a correct estimate of the articles needed and the length of time required for the various types of cases.

In the New York Post-Graduate Hospital the very practical work done, each year, at graduation, in the interesting public demonstration including this feature, has proved of enormous value to all its students in their after careers, whether as private nurses or teachers of others, visiting nurses or those more fortunate, glorious women who served their country in the late war, on the firing-line, with their surgeons, everywhere, under dropping shells, on canal barges, in hospital tents, or beneath the open sky.

CHAPTER XXII

THE IDEAL SURGEON

Nurses should pause, in the early days of their operating-room service, to reflect that, of the enormous mass of detail that they are privileged to view here, all was discovered by thousands of surgeons, at different periods, from five centuries before Christ, to the present day, of many nationalities, including Greece, Rome, Germany, Belgium, modern Italy, and Britain. The first American surgeon became known about 1750. It is tonic to look far back, and realize that the Old World initiated and perfected what we now enjoy by copying. It is none the less necessary to look far into the future and visualize the surgery of a later era, wondering what can yet be discovered. Here are a few sketches of men who loved their fellow beings, and in trying to help certain ills, benefited all humanity. It is hoped that some such one will arise and bring a cure for cancer and the remaining diseases that puzzle and baffle modern science. In the roll of fame, many names of surgeons stand out conspicuously, because the debt owed them in lives, health, and community prosperity is incalculable.

Hippocrates.—Much is due the early Greeks, a nation that pursued intellectual interests, for the foundation of surgery. Hippocrates, who was born about 470 B. C., in a family of medical traditions, not only swore his famous oath, thus becoming our recognized, complete guide in ethics, but performed and wrote of trephining, herniotomy, thoracotomy and even suprapubic lithotomy.

"I swear by Apollo, the physician, and Æsculapius, and Health, and All-heal, and all the gods and goddesses, that according to my ability and judgment, I will keep this oath and stipulation: to reckon him who taught me this

art equally dear to me as my parents, to share my substance with him and relieve his necessities if required; to regard his offspring as on the same footing with my own brothers, and to teach them this art if they wish to learn it, without fee or stipulation, and that by precept, lecture, and every other mode of instruction I will impart a knowledge of this art to my own sons and those of my teachers, and to disciples bound by a stipulation and oath, according to the law of medicine, but to none others.

"I will follow that method of tretament which, according to my ability and judgment, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous. I will give no deadly medicine to anyone if asked, nor suggest any such counsel; furthermore, I will not give to a woman an instrument to produce abortion.

"With purity and with holiness I will pass my life and practice my art. I will not cut a person who is suffering with stone, but will leave this to be done by practitioners of this work. Into whatever house I enter, I will go into them for the benefit of the sick and will abstain from every voluntary act of mischief and corruption; and further from the seduction of females or males, bond or free.

"Whatever, in connection with my professional practice, or not in connection with it, I may see or hear in the lives of men which ought not to be spoken abroad, I will not divulge, as reckoning that all such should be kept secret.

"While I continue to keep this oath unviolated, may it be granted to me to enjoy life and the practice of the art, respected by all men at all times, but should I trespass and violate this oath, may the reverse be my lot."

Galen.—Equally familiar is the name of Galen used in the expression, "sitting at the feet of Galen," to signify studying medicine. Galen was born about 131 A. D., in Greece, six hundred years later than Hippocrates, and twelve hundred years before de Chauliac, remaining the leader of medical thought for sixteen centuries. He it was who discovered and demonstrated in surgical practice

the nature and duties of the arterial system, more especially anastomosis and ligation.

Guy de Chauliac.—An interesting article appeared among the book reviews in a recent issue of the Journal of the American Medical Association,[1] which presents in ideal, concise way the qualities necessary in a surgeon, who is in a very responsible position, when educational preceptor for interns and nurses who must from him alone absorb the principles underlying their own future conduct toward their clientèle.

"Guy de Chauliac, generally known as the 'Father of Surgery,' was born in France in the last years of the thirteenth century. Like most of the surgeons of his time, he practised under the patronage of a feudal lord. He studied in Montpellier, Bologna, and Paris, and was physician to several of the popes, who conferred special dignities on him. When he compiled his great surgical text-book, copies were promptly made in various languages. The English edition was first published in 1541. The great work consists of seven parts, including anatomy, apostems, wounds, ulcers, fractures and dislocations, special diseases, and antidotes.

"Mr. Brennan's text opens with the famous description of the qualities of a surgeon:

"The conditions necessary for the surgeon are four: first, he should be learned; second, he should be expert; third, he must be ingenious, and fourth, he should be able to adapt himself. It is required for the first that the surgeon should know not only the principles of surgery but also those of medicine in theory and practice; for the second, that he should have seen others operate; for the third, that he should be ingenious, of good judgment and memory to recognize conditions; and for the fourth, that he be adaptable and able to accommodate himself to circumstances. Let the surgeon be bold in all sure things, and fearful in dangerous things; let him avoid all faulty treatments and practices. He ought to be gracious to the sick, considerate to his associates, cautious in his prognostications. Let him be modest, dignified, gentle, pitiful, and merciful; not covetous nor an extortionist of money; but rather let his reward be according to his work, to the means of the patient, to the quality of the issue, and to his own dignity."

[1] Guy de Chauliac (A. D. 1363), On Wounds and Fractures. Translated by W. A. Brennan, A. B.

"In selecting from the complete text, Mr. Brennan has chosen wisely, giving a view of not only the surgical work such as ligature and suturing, but also bandaging and the application of drugs. The translation is simple and very well done."

It would be attempting to paint the lily to comment on this description further than to emphasize the need for nurses to be reserved and careful in their judgments of the mental and moral caliber of those under whose direction they work, and to gage them silently by this fine, sure standard, which covers every phase of their work in a manner parallel to that implied in the Pledge of Florence Nightingale and the Oath of Hippocrates.

Vesalius.—The modern method of developing successful surgeons is based on the dissecting of the cadaver, with lectures, then assisting in the operating room while intern, where latent talent may appear. Even the nurse, who is only humble handmaiden to the operator, works more intelligently, by quick anticipation of needs, after having seen dissection in specimens and necropsies. In 1514, in Brussels, was born Vesalius, inheriting strong leanings toward surgery from a long line of ancestors, and educated at the wonderful old University of Louvain, the restoration of which, since its destruction by the Germans in the Great War, has occupied the mind and heart of so many Americans. He had to cope with tradition and fierce prejudice in his efforts to teach anatomy by dissection, and while his students adored him, the conservative world was arrayed against him, much as now on vivisection, when the only way to make and ensure certain discoveries is promptly howled down by permanent groups of destructive critics. But he established the method, and it will always stand.

Pare.—To this great Frenchman, 1510–1590, we owe our knowledge of proper handling of gunshot wounds (letting them alone) and the end ligature in amputation stumps. It must have been a joy to the patients in the then nine centuries old Hotel Dieu, in Paris, when this

young house doctor, only twenty-three, for the first time in the world treated his patients painlessly, applied soft, comfortable dressings, cleansed the wounds, and stayed them with deft roller bandages. That was four centuries ago. What must his ghost have thought when he saw troops of American nurses invade Paris!

Hunter.—Crossing from the continent to the "right little, tight little island," we touch upon Hunter, born in Scotland in 1728. Educated in London, he became an expert student of anatomy, and on his observations is based all we are taught in training-schools about inflammation, as well as placental circulation and the function of the great middleman of our system, the lymphatics, with which we nurses have yet only a frigid bowing acquaintance. The chief inspiration to be gained from his life is that of endless industry and boundless catholicity of tastes, embracing with equal fervor geology and trout fishing.

Moving ever westward, it is interesting to note the almost martyrdom of the early American gynecologist, **McDowell,** born in Virginia, in 1771, of whose life it is one of the fond traditions of the Woman's Hospital that he was mobbed for days, heckled, jeered, and stoned when he performed the first ovariotomy, and that the jeers after a week turned to praise, and the stones to flowers.

F. Marion Sims, later, born in 1813, true founder of gynecologic surgery, seeing how many women were condemned to lifelong torment by dripping vesicovaginal fistulæ, caused by the death of patches of tissue subjected to long pressure in difficult labor early in their married life, successfully experimented with silver wire sutures and relieved so many, rich and poor, that in gratitude the famous Woman's Hospital in the State of New York was opened to extend his opportunities to do good.

Lord Lister.—This kindly man, with his trenchant wit, but unassuming manner, lived till our own time, and links the present with the past for us by depicting the "laudable pus" calmly taken as a matter of fact, in every

wound, laudable if it did not kill, and the attending high death-rate in hospitals from sepsis. The deep hostility of our older generation, our own grandfathers, to hospitals, is in the main, based on stories handed down to them from the first quarter of this nineteenth century. Nurses cannot imagine wards now without disinfectants, isolation of cases, and careful diagnosis on admission. The comfort and safety of modern hospitals is entirely due to Lister's exposition and demonstration of the theory of antiseptics, from which the step to "asepsis" is painless and easy. The same air that Lister breathed stimulated Pasteur to his twin theory of the life of bacteria. The honors paid these men are now equal. Soldiers of every land felt more secure in following the flag since these men have lived and nations have delighted to praise them. When nurses see that so much can be accomplished for mankind within the span of one life our own behavior and line of thought unconsciously are lifted to a more dignified and lofty plane, being, in a humble way, partners in that divine emotion that supported famous men through long, hard days and nights, amid privations and rebuffs, to alleviate human ills.

Author's Note.—The information of this chapter was compiled from well-known works on surgery, too numerous to mention.

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